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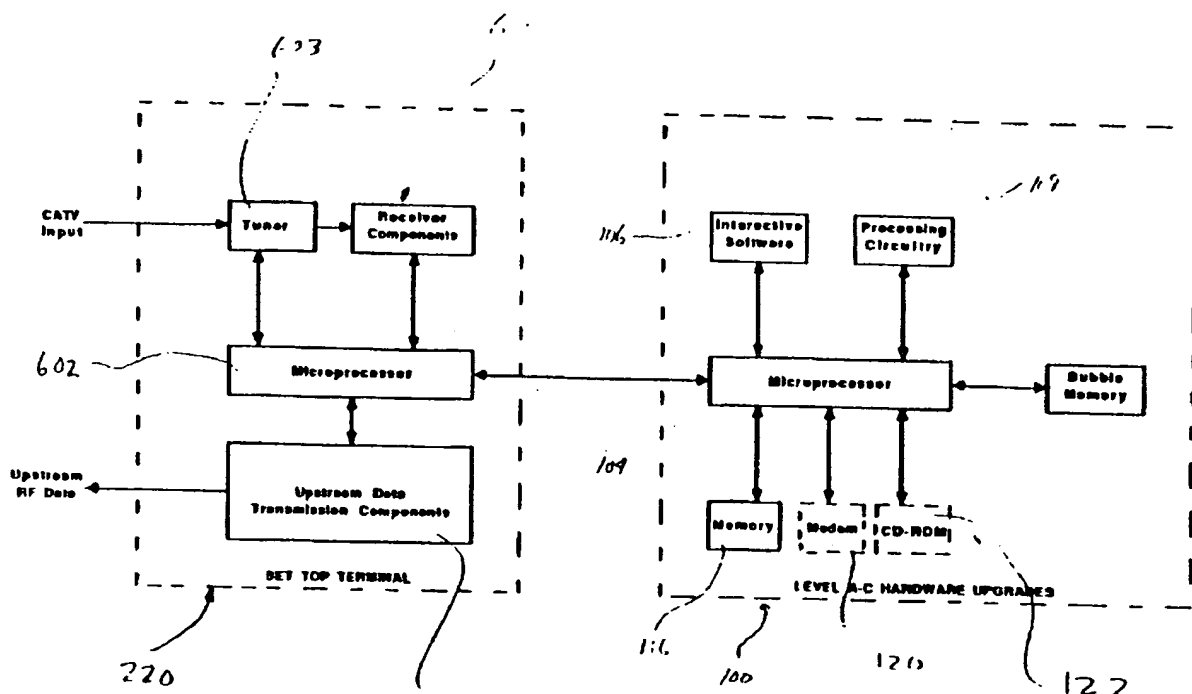
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(54) Titre : TERMINAL PERFECTIONNE INSTALLABLE SUR UN TELEVEUR POUR SYSTEME DE TELEVISION CABLE

(54) Title: ADVANCED SET TOP TERMINAL FOR CABLE TELEVISION DELIVERY SYSTEMS

(57) Abrégé/Abstract:

A novel advanced set top terminal capable of digital decompression, menu generation, interactivity and other advanced functional capabilities for use in a television program delivery system (200) is described. The invention relates to methods and apparatus for upgrading existing set top terminals (220) to provide menu generation capability and advanced functional capabilities. The invention is particularly useful is television program delivery systems (200) with hundreds of channels of

(57) Abrégé(suite)/Abstract(continued):

programming, providing (i) menu driven program selection through the addition of as upgrade module (300) or menu generation card and (ii) advanced functional capabilities using a set of hardware upgrades (e.g. 130) and/or an expansion card. Specifically, the invention is as upgradeable system that supports advanced set top functionality through the use of internal software, hardware upgrades, an upgrade module and/or expansion cards. The upgraded hardware generally includes a microprocessor, various input/ouput ports (e.g.. 308). processing circuitry (e.g.. 108) and memory (e.g., 116). The invention results in as upgraded set tap terminal that supports: menu generation: picture-on-picture displays: program catalogue services. interactive services: telephone caller identification: digital audio reception; VCR control; HDTV reception: and backyard satellite system interoperabilty, among other features and capabilities.

PCT

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(57) Abstract

A novel advanced set top terminal capable of digital decompression, menu generation, interactivity and other advanced functional capabilities for use in a television program delivery system (200) is described. The invention relates to methods and apparatus for upgrading existing set top terminals (220) to provide menu generation capability and advanced functional capabilities. The invention is particularly useful in television program delivery systems (200) with hundreds of channels of programming, providing (i) menu driven program selection through the addition of an upgrade module (300) or menu generation card and (ii) advanced functional capabilities using a set of hardware upgrades (e.g. 130) and/or an expansion card. Specifically, the invention is an upgradeable system that supports advanced set top functionality through the use of internal software, hardware upgrades, an upgrade module and/or expansion cards. The upgraded hardware generally includes a microprocessor, various input/ouput ports (e.g., 308), processing circuitry (e.g., 108) and memory (e.g., 116). The invention results in an upgraded set top terminal that supports: menu generation; picture-on-picture displays; program catalogue services, interactive services; telephone caller identification; digital audio reception; VCR control; HDTV reception; and backyard satellite system interoperability, among other features and capabilities.

ADVANCED SET TOP TERMINAL FOR CABLE
TELEVISION DELIVERY SYSTEMS

This is a divisional of Canadian Patent Application Number 2,151,461

5   which is the national phase application of PCT International Application Number

PCT/US93/11606 filed December 2, 1993.

TECHNICAL FIELD

The invention relates to television entertainment systems for providing

10   television programming to consumer homes. More particularly, the invention

relates to a set top terminal for use with a program delivery system with menu

selection of programs.

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BACKGROUND OF THE INVENTION

Advances in television entertainment have been primarily driven by breakthroughs in technology. In 1939, advances on Vladmir Zworykin's picture tube provided the

5   stimulus for NBC to begin its first regular broadcasts. In 1975, advances in satellite technology provided consumers with increased programming to homes.

Many of these technology breakthroughs have produced inconvenient systems for consumers. One example is the

10   ubiquitous three remote control home, having a separate and unique remote control for the TV, cable box and VCR. More recently, technology has provided cable users in certain parts of the country with 100 channels of programming. This increased program capacity is beyond the ability of many

15   consumers to use effectively. No method of managing the program choices has been provided to consumers.

Consumers are demanding that future advances in television entertainment, particularly programs and program choices, be presented to the consumer in a user friendly

20   manner. Consumer preferences, instead of technological breakthroughs, will drive the television entertainment market for at least the next 20 years. As computer vendors have experienced a switch from marketing new technology in computer hardware to marketing better useability, interfaces

25   and service, the television entertainment industry will also experience a switch from new technology driving the market to consumer useability driving the market.

Consumers want products incorporating new technology that are useful, and will no longer purchase new

30   technology for the sake of novelty or status. Technological advances in sophisticated hardware are beginning to surpass the capability of the average consumer to use the new

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technology. Careful engineering must be done to make entertainment products incorporating new technology useful and desired by consumers.

In order for new television entertainment products to
5   be successful, the products must satisfy consumer demands. TV consumers wish to go from limited viewing choices to a variety of choices, from no control of programming to complete control. Consumers wish to advance from cumbersome and inconvenient television to easy and
10   convenient television and keep costs down. Consumers do not wish to pay for one hundred channels when due to lack of programming information, they seldom, if ever, watch programming on many of these channels.

The concepts of interactive television, high definition
15   television and 300 channel cable systems in consumer homes will not sell if they are not packaged, delivered and presented in a useable fashion to consumers. The problem is that TV programming is not being delivered and presented to consumers in a user friendly manner.

20   Consumers are already being bombarded with programming options, numerous "free" cable channels, subscription cable channels and pay-per-view choices. Any further increase in TV entertainment choices, without a user friendly presentation and approach, will likely bewilder
25   viewers with a mind-numbing array of choices.

The TV industry has traditionally marketed and sold its programs to consumers in bulk, such as continuous feed broadcast and long-term subscriptions to movie channels. The TV industry is unable to sell its programming in large
30   quantities on a unit per unit basis, such as the ordering of one program. Consumers prefer a unit sales approach because it

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keeps costs down and allows the consumer to be more selective in their viewing.

In addition. viewership fragmentation. which has already begun. will increase. Programming not presented in a
5 user friendly manner will suffer with a decrease in viewership and revenue. As programming presentation becomes more user friendly. users seek additional features and functional capabilities.

What is needed is a system which can deliver and
10 present television programming through a user friendly interface which allows the consumer to easily select from among the many program choices.

What is needed is a set top converter that provides a user friendly interface for subscribers to access television
15 programs.

What is needed is a set top converter with enhanced functionality.

What is needed is a set top converter that provides users with advanced features and capabilities.
20   What is needed is a method that allows efficient access to hundreds of television programming options.

What is needed is technology that upgrades the functionality of existing set top converters.

What is needed is hardware that provides an upgrade
25 capability allowing the use of existing set top converter technology in advanced program delivery systems.

What is needed is a set top converter that provides an upstream communications capability between the set top converter and cable headend.
30   What is needed is a set top converter that provides a capability of generating menus for display.

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What is needed is a set top converter that provides a simple way to select a program from a menu.

What is needed is a set top converter that allows users to subscribe on-screen to specialty channels.

5   What is needed is a set top converter that monitors subscriber viewing choices for statistical purposes.

What is needed is a set top converter that provides sophisticated on-screen television menus which can incorporate still video and moving video.

What is needed is a set top converter that provides a capability of scaling 10   and redirecting video for menus. The present invention is addressed to fulfill these needs.

SUMMARY OF INVENTION

The present invention is a set top converter box or terminal for a television program delivery system. More specifically, the present invention is 15   an advanced set top converter box that acts as a terminal in the viewer home. The set top terminal is a key component of a digital cable television delivery system. The set top terminal is an upgradeable system that provides for the decompression of digital program signals. The preferred set top terminal provides both a menu generation capability as well as a number of advanced 20   features and functional capabilities.

Accordingly, in one of its aspects, the present invention provides a hardware upgrade for a terminal, the hardware upgrade comprising: an interface to the terminal whereby subscriber selections and audio signals that represent audio programs may be received; audio processing circuitry, 25   connected to the interface, that processes the audio signals; and an output, connected to the processing circuitry, that outputs a selected audio signal based on the subscriber selections.

In a further aspect, the present invention provides a hardware upgrade for a terminal for use with a television program delivery system, the hardware 30   upgrade comprising: an interface to the terminal, whereby interactive subscriber input is transferred from the terminal for processing and interactive output is transferred to the terminal for display; a memory storing interactive software;

and a microprocessor, connected to the interface and memory, that processes the interactive subscriber input and produces the interactive output in accordance with the interactive software.

In a further aspect, the present invention provides a hardware upgrade for enhancing the functionality of a set top converter in a television program delivery system, each set top converter having a mailbox adapted to receive electronic mail, the hardware upgrade comprising: an interface for providing an electrical connection to the set top converter, whereby the electronic mail is transferred from the set top converter for processing and the processed electronic mail is passed to the set top converter for display; a memory for storing interactive programming instructions; and at least one microprocessor connected to said memory and connected to said interface for accessing the stored interactive programming instructions and for processing the electronic mail to produce processed electronic mail based on the stored interactive programming instructions.

In a still further aspect, the present invention provides an apparatus for outputting a plurality of signals, comprising: a plurality of tuners for tuning to a plurality of programs; a plurality of decompressors; and a plurality of output ports connected to the plurality of decompressors, wherein at least two of the plurality of output ports are connected to different tuners of the plurality of tuners.

In a further aspect, the present invention provides an apparatus that provides access to data bases in a telecommunications network, comprising: an input that connects to the telecommunications network, the input sending connection signals to the data bases and receiving data from data bases successfully connected thereto; a first memory coupled to the input that stores the data received from the data bases; a second memory coupled to the input that stores programming instructions; and a processor coupled to the input and the first and the second memories, the processor accessing the programming instructions to send the connection signals, process the data received from the data bases and store the received data in the first memory.

In a further aspect, the present invention provides an upgrade module for enhancing the functionality of a decompression box for use in a television program delivery system, the upgrade module comprising: an interface connected to the decompression box, wherein said interface receives a control information stream from the decompression box; a demultiplexer to demultiplex the control information stream into graphics and text; a combiner coupled to the demultiplexer, wherein the combiner combines the text and graphics to produce a menu generation signal; means for transferring the menu generation signal to the interface for output to the decompression box, wherein the menu generation signal is processed for display; and digital signal components that receive and process a high definition television signal.

In a further aspect, the present invention provides a hardware upgrade for a terminal for use with a television program delivery system, the hardware upgrade comprising: an interface to the terminal; and a modem connected to the interface.

In a further aspect, the present invention provides a hardware upgrade for a terminal for use with a television program delivery system, the hardware upgrade comprising: an interface to the terminal; and a disc storage device connected to the interface.

In a further aspect, the present invention provides a set top terminal for use with a television, with menu selection of television programs and accompanying audio signals from a set of menus, using a program control information signal containing program identities and menu locations within the set of menus for the program identities comprising: a receiver, wherein the program control information signal is received; a menu memory, connected to the receiver, for storing the program identities and menu locations within the set of menus for the program identities; means, connected to the menu memory, for generating menus from the set of menus, including a program identity subset menu containing program identifies, wherein the means for generating uses the program identities and the menu locations for the program identities stored in the menu memory; processor means, connected to the generating means for sequencing between menus within the set of menus to generate one menu at a

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time wherein at least one of the generated menus is from the program identity subset of menus; and means, in communication with the processor means, for selecting a program by choosing a program identity from a generated menu and for selecting accompanying audio from a generated menu.

5   In a further aspect, the present invention provides a method for accommodating language preferences of subscribers in a program delivery system, wherein multiple audio signals correspond to the same program and wherein the multiple audio signals comprise signals of multiple languages, the method comprising: accepting a language selection from a subscriber; and

10   generating one or more menus of programs available in the selected language.

In a further aspect, the present invention provides a method for automatically pausing a video program in response to an occurrence of an event, comprising: receiving a video program and outputting the video program for presentation on a display device; detecting occurrence of a communications

15   event during the video program; pausing the video program in response to the detection of the occurrence of the communications event; and outputting a signal for displaying an indication of the occurrence of the communications event.

The set top terminal of the present invention may be achieved through a set of hardware upgrades to any of the following embodiments: (1) an existing

20   set top converter upgraded with a circuit card (which has a microprocessor electronically connected to the set top converter); (2) an industry standard decompression converter upgradeable by either an upgrade module or a menu generation card; and (3) a set top converter box capable of both decompression and menu generation. The hardware upgrades provide additional

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advanced features and functional capabilities to any of these embodiments.

A number of advanced features and functional capabilities are supported by the preferred set top terminal.
5   This set top terminal provides subscribers with a picture-on-picture capability without requiring a special television to support the capability. The set top terminal also supports a TV guide service, which provides subscribers with information on all programming available at its particular
10   subscriber location. The set top terminal further includes the capability of querying viewers to establish, among other things, favorite channel lists, personal profile data and mood information. The set top terminal allows the subscriber to view promotional menus on future programming events.

15   The set top terminal supports additional capabilities using its hardware upgrades that allow subscribers to use other interactive services, for example, to engage in on-line question and answer sessions, to order and confirm airline tickets, and to access a variety of other data services. The set
20   top terminal makes use of a digital tuner as a hardware upgrade to provide subscribers with a digital audio capability.

The preferred set top terminal may be used to control video tape machines, thereby simplifying the recording of programs. The set top terminal can, in conjunction with the
25   program delivery system, easily support high definition television (HDTV). For subscribers living in remote locations, the set top terminal accommodates backyard satellite systems. In addition to all the features that the set top terminal supports with its current internal programming and
30   upgradeability, additional features may be added or existing features increased through remote reprogramming of the set top terminal 220.

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It is an object of the invention to provide a user friendly interface for subscribers to access television programs.

It is an object of the invention to allow users to easily navigate through hundreds of programming choices using on-screen menus.

It is an object of this invention to efficiently access hundreds of television programming options.

It is an object of this invention to upgrade the functionality of existing set top converters.

It is an object of this invention to provide an upgrade capability allowing the use of existing set top converter technology in an advanced program delivery system.

It is an object of this invention to provide an upstream communications capability between the set top converter and cable headend.

It is an object of this invention to provide a set top terminal capable of generating menus for display.

It is an object of this invention to allow users to subscribe on-screen to specialty channels.

It is an object of this invention to monitor subscriber viewing choices for statistical purposes.

It is an object of this invention to provide sophisticated on-screen television menus which can incorporate still video and moving video.

These and other objects and advantages of the invention will become obvious to those skilled in the art upon review of the following description. the attached drawings and appended claims.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram of the primary components of the television delivery system.

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Figure 2 is an overview of the television delivery system operations.

Figure 3 is a schematic of the operation of the primary components of the system.

5   Figure 4 is a block diagram of the hardware components of the set top terminal.

Figure 5a is a perspective front view of a set top terminal.

Figure 5b is a perspective rear view of a set top

10   terminal.

Figure 6 is a schematic of a Turbo card upgrade for a set top terminal.

Figure 7a is a drawing of a frame format for program control information signal.

15   Figure 7b is a drawing of a frame format for a polling response from the set top terminal.

Figure 8 is a drawing of the basic menus used in the present invention. Including the ten major menus represented by icons.

20   Figure 9a is a schematic of a basic decompression box with upgrade module and associated connections.

Figure 9b is a schematic of an alternative embodiment of a simple decompression box with upgrade module and associated connections.

25   Figure 10 is a more detailed block diagram of the components of a simple decompression box with upgrade module.

Figure 11 is a schematic of the set top terminal's upstream data transmission hardware.

30   Figure 12a is a schematic showing the components of the Level A, B, and C hardware upgrades.

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Figure 12b is a schematic showing the components of the Level D hardware upgrade.

Figure 13a is a schematic showing the two parts of a remote control unit.

5   Figure 13b is a drawing of the preferred remote control unit.

Figure 14 is a diagram of the components of a set top terminal having a picture-on-picture capability.

Figure 15 is a drawing of a menu related to program
10   catalogue services.

Figures 16a through 16d are drawings of viewer querying and mood question menus.

Figures 17a and 17b are drawings of the set top terminal hardware components that accommodate
15   transparent channel switching.

Figure 18 is a drawing of an interactive television promotional menu for a set top terminal hardware upgrade.

Figures 19a and 19b are drawings of submenus for interactive television services using hardware upgrade Level
20   A.

Figures 20a through 20d are drawings of interactive services using hardware upgrade Level B, which are related to on-screen airline reservations.

Figure 21 is a drawing of a menu for digital audio
25   services.

Figure 22 is a drawing of a menu related to program guide services.

Figure 23 is a drawing of a menu related to high definition television (HDTV) programming.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A   Television Program Delivery System Description

1.   Introduction

5   Figure 1 shows the present invention as part of an expanded cable television program delivery system 200 that dramatically increases programming capacity using compressed transmission of television program signals. Developments in digital bandwidth compression technology

10   now allow much greater throughput of television program signals over existing or slightly modified transmission media. The program delivery system 200 shown provides subscribers with a user friendly interface to operate and exploit a six-fold or more increase in current program delivery capability.

15   Subscribers are able to access an expanded television program package and view selected programs through a menu-driven access scheme that allows each subscriber to select individual programs by sequencing a series of menus. The menus are sequenced by the subscriber using simple

20   alpha-numeric and iconic character access or moving a cursor or highlight bar on the TV screen to access desired programs by simply pressing a single button, rather than recalling from memory and pressing the actual two or more digit numeric number assigned to a selection. Thus, with the press of a

25   single button, the subscriber can advance from one menu to the next. In this fashion, the subscriber can sequence the menus and select a program from any given menu. The programs are grouped by category so that similar program offerings are found on the same menu.

30   #### 2.   Major System Components

In its most basic form, the system uses a program delivery system 200 in conjunction with a conventional

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concatenated cable television system 210. The program
delivery system 200 generally includes (i) at least one
operations center 202, where program packaging and control
information are created and then assembled in the form of

5   digital data, (ii) a digital compression system, where the
digital data is compressed, combined/multiplexed, encoded,
and mapped into digital signals for satellite transmission to
the cable headend 208, and (iii) a set of in-home
decompressors. The program delivery system 200 transports

10   the digital signals to the cable headend 208 where the signals
are transmitted through a concatenated cable television
system 210. Within the cable headend 208, the received
signals may be decoded, demultiplexed, managed by a local
central distribution and switching mechanism, combined and

15   then transmitted to the set top terminal 220 located in each
subscriber's home over the cable system 210. Although
concatenated cable systems 210 are the most prevalent
transmission media to the home, telephone lines, cellular
networks, fiberoptics, Personal Communication Networks and

20   similar technology for transmitting to the home can be used
interchangeably with this program delivery system 200.

The delivery system 200 has a reception region 207
with an in-home decompression capability. This capability is
performed by a decompressor housed within a set top

25   terminal 220 in each subscriber's home. The decompressor
remains transparent from the subscriber's point of view and
allows any of the compressed signals to be demultiplexed and
individually extracted from the composite data stream and
then individually decompressed upon selection by the

30   subscriber. The decompressed video signals are converted
into analog signals for television display. Such analog signals
include NTSC formatted signals for use by a standard

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television. Control signals are likewise extracted and
decompressed and then either executed immediately or
placed in local storage such as a RAM. Multiple sets of
decompression hardware may be used to decompress video

5   and control signals. The set top terminal 220 may then
overlay or combine different signals to form the desired
display on the subscriber's television. Graphics on video or
picture-on-picture are examples of such a display.

Although a single digital compression standard (e.g..

10   MPEG) may be used for both the program delivery system
200 and the concatenated cable system 210. the compression
technique used may differ between the two systems. When
the compression standards differ between the two media. the
signals received by the cable headend 208 must be

15   decompressed before transmission from the headend 208 to
the set top terminals 220. Subsequently. the cable headend
208 must recompress and transmit the signals to the set top
terminal 220. which would then decompress the signals
using a specific decompression algorithm.

20   The video signals and program control signals received
by the set top terminal 220 correspond to specific television
programs and menu selections that each subscriber may
access through a subscriber interface. The subscriber
interface is a device with buttons located on the set top

25   terminal 220 or on a portable remote control 900. In the
preferred system embodiment. the subscriber interface is a
combined alpha-character. numeric and iconic remote
control device 900. which provides direct or menu-driven
program access. The preferred subscriber interface also

30   contains cursor movement and go buttons as well as alpha.
numeric and iconic buttons. This subscriber interface and
menu arrangement enables the subscriber to sequence

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through menus by choosing from among several menu options
that are displayed on the television screen. In addition, a
user may bypass several menu screens and immediately
choose a program by selecting the appropriate alpha-
5   character, numeric or iconic combinations on the subscriber
interface. In the preferred embodiment, the set top terminal
220 generates the menus that are displayed on the television
by creating arrays of particular menu templates, and the set
top terminal 220 displays a specific menu or submenu option
10 for each available video signal.

        3.   **Operations Center and Digital Compression
              System**

The operations center 202 performs two primary
15 services, packaging television programs and generating the
program control information signal. At the operations center
202, television programs are received from external program
sources in both analog and digital form. Figure 2 shows an
embodiment of the operations center receiving signals from
20 various external sources 212. Examples of the external
program sources are sporting events, children's programs,
specialty channels, news or any other program source that
can provide audio or visual signals. Once the programs are
received from the external program sources, the operations
25 center 202 digitizes (and preferably compresses) any
program signals received in analog form. The operations
center 202 may also maintain an internal storage of programs.
The internally stored programs may be in analog or digital
form and stored on permanent or volatile memory sources,
30 including magnetic tape or RAM. Subsequent to receiving
programming, the operations center 202 packages the
programs into the groups and categories which provide the
optimal marketing of the programs to subscribers. For

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example. the operations center 202 may package the same
programs into different categories and menus for weekday.
prime-time viewing and Saturday afternoon viewing. Also, the
operations center 202 packages the television programs in a
5   manner that enables both the various menus to easily
represent the programs and the subscribers to easily access
the programs through the menus.

The packaging of the digital signals is typically
performed at the operations center 202 by computer assisted
10   packaging equipment (CAP). The CAP system normally
includes at least one computer monitor. keyboard. mouse.
and standard video editing equipment. A programmer
packages the signals by entering certain information into the
CAP. This information includes the date. time slot. and
15   program category of the various programs. The programmer
and the CAP utilize demographic data and ratings in
performing the packaging tasks. After the programmer
selects the various programs from a pool of available programs
and inputs the requisite information. the programmer. with
20   assistance from the CAP. can select the price and allocate
transponder space for the various programs. After the
process is complete. the CAP displays draft menus or
program schedules that correspond to the entries of the
programmer. The CAP may also graphically display allocation
25   of transponder space. The programmer may edit the menus
and transponder allocation several times until satisfied with
the programming schedule. During the editing. the
programmer may direct the exact location of any program
name on a menu with simple commands to the CAP.
30   The packaging process also accounts for any groupings
by satellite transponder which are necessary. The operations
center 202 may send different groups of programs to

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different cable headends 208 and/or set top terminals 220.
One way the operations center 202 may accomplish this task
is to send different program packages to each transponder.
Each transponder. or set of transponders. then relays a

5   specific program package to specific cable headends 208
and/or set top terminals 220. The allocation of transponder
space is an important task performed by the operations
center 202.

The operations center 202 may also "insert" directions

10   for filling local available program time in the packaged signal
to enable local cable and television companies to fill the
program time with local advertising and/or local
programming. Consequently. the local cable headends 208
are not constrained to show only programs transmitted from

15   the operations center 202. New set top converters will
incorporate both digital and analog channels. Therefore. the
cable headend 208 may combine analog signals with the
digital signals prior to transmitting the program signals to
the set top terminals 220.

20   After the CAP packages the programs. it creates a
program control information signal to be delivered with the
program package to the cable headend 208 and/or set top
terminal 220. The program control information signal
contains a description of the contents of the program

25   package. commands to be sent to the cable headend 208
and/or set top terminal 220. and other information relevant
to the signal transmission.

In addition to packaging the signal. the operations
center 202 employs digital compression techniques to

30   increase existing satellite transponder capacity by at least a
4:1 ratio. resulting in a four-fold increase in program delivery
capability. A number of digital compression algorithms

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currently exist which can achieve the resultant increase in
capacity and improved signal quality desired for the system.
The algorithms generally use one or more of three basic
digital compression techniques: (1) within-frame (intraframe)
5   compression, (2) frame-to-frame (interframe) compression,
and (3) within carrier compression. Specifically, in the
preferred embodiment, the MPEG 2 compression method is
used. After digital compression, the signals are combined
(multiplexed) and encoded. The combined signal is
10   subsequently transmitted to various uplink sites 204.

There may be a single uplink site 204 or multiple
uplink sites (represented by 204', shown in phantom in
Figure 1) for each operation center 202. The uplink sites
204 may either be located in the same geographical place or
15   may be located remotely from the operations center 202.
Once the composite signal is transmitted to the uplink sites
204, the signal may be multiplexed with other signals,
modulated, upconverted and amplified for transmission over
satellite. Multiple cable headends 208 may receive such
20   transmissions.

In addition to multiple uplinks, the delivery system 200
may also contain multiple operations centers. The preferred
method for using multiple operations centers is to designate
one of the operations centers as a master operations center
25   and to designate the remaining operations centers as slave
operations centers. In this configuration, the master
operations center coordinates various functions among the
slave operations centers such as synchronization of
simultaneous transmissions and distributes the operations
30   workload efficiently.

4.   Cable Headend

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After the operations center 202 has compressed and encoded the program signals and transmitted the signals to the satellite, the cable headend 208 receives and further processes the signals before they are relayed to each set top

5   terminal 220. Each cable headend site is generally equipped with multiple satellite receiver dishes. Each dish is capable of handling multiple transponder signals from a single satellite and sometimes from multiple satellites.

As an intermediary between the set top terminals 220

10 and the operations center 202 (or other remote site), the cable headend 208 performs two primary functions. First, the cable headend 208 acts as a distribution center, or signal processor, by relaying the program signal to the set top terminal 220 in each subscriber's home. In addition, the

15 cable headend 208 acts as a network controller 214 by receiving information from each set top terminal 220 and passing such information on to an information gathering site such as the operations center 202.

Figure 3 shows an embodiment where the cable

20 headend 208 and the subscriber's home are linked by certain communications media 216. In this particular embodiment, analog signals, digitally compressed signals, other digital signals and up-stream/interactivity signals are sent and received over the media 216. The cable headend 208

25 provides such signaling capabilities in its dual roles as a signal processor 209 and network controller 214.

As a signal processor 209, the cable headend 208 prepares the program signals that are received by the cable headend 208 for transmission to each set top terminal 220.

30 In the preferred system, the signal processor 209 re-routes or demultiplexes and recombines the signals and digital information received from the operations center 202 and

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allocates different portions of the signal to different
frequency ranges. Cable headends 208 which offer different
subscribers different program offerings may allocate the
program signals from the operations center 202 in various

5   manners to accommodate different viewers. The signal
processor 209 may also incorporate local programming
and/or local advertisements into the program signal and
forward the revised signal to the set top terminals 220. To
accommodate this local programming availability, the signal

10   processor 209 must combine the local signal in digital or
analog form with the operations center program signals. If
the local cable system uses a compression standard that is
different than the one used by the operations center 202, the
signal processor 209 must also decompress and recompress

15   incoming signals so they may be properly formatted for
transmission to the set top terminals 220. This process
becomes less important as standards develop (i.e., MPEG 2).
In addition, the signal processor 209 performs any necessary
signal decryption and/or encryption.

20   As a network controller 214, the cable headend 208
performs the system control functions for the system. The
primary function of the network controller 214 is to manage
the configuration of the set top terminals 220 and process
signals received from the set top terminals 220. In the

25   preferred embodiment, the network controller 214
monitors, among other things, automatic poll-back responses
from the set top terminals 220 remotely located at each
subscribers' home. The polling and automatic report-back
cycle occurs frequently enough to allow the network

30   controller 214 to maintain accurate account and billing
information as well as monitor authorized channel access. In
the simplest embodiment, information to be sent to the

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network controller 214 will be stored in RAM within each subscriber's set top terminal 220 and will be retrieved only upon polling by the network controller 214. Retrieval may, for example, occur on a daily, weekly or monthly basis. The
5   network controller 214 allows the system to maintain complete information on all programs watched using a particular set top terminal 220.

The network controller 214 is also able to respond to the immediate needs of a set top terminal 220 by modifying a
10   program control information signal received from the operations center 202. Therefore, the network controller 214 enables the delivery system to adapt to the specific requirements of individual set top terminals 220 when the requirements cannot be provided to the operations center
15   202 in advance. In other words, the network controller 214 is able to perform "on the fly programming" changes. With this capability, the network controller 214 can handle sophisticated local programming needs such as, for example, interactive television services, split screen video, and
20   selection of different foreign languages for the same video. In addition, the network controller 214 controls and monitors all compressors and decompressors in the system.

The delivery system 200 and digital compression of the preferred embodiment provides a one-way path from the
25   operations center 202 to the cable headend 208. Status and billing information is sent from the set top terminal 220 to the network controller 214 at the cable headend 208 and not directly to the operations center 202. Thus, program monitoring and selection control will take place only at the
30   cable headend 208 by the local cable company and its decentralized network controllers 214 (i.e., decentralized relative to the operations center 202, which is central to the

20

program delivery system 200). The local cable company will
in turn be in communication with the operations center 202
or a regional control center (not shown) which accumulates
return data from the set top terminal 220 for statistical or
5   billing purposes. In alternative system embodiments, the
operations center 202 and the statistical and billing sites are
collocated. Further, telephone lines with modems are used
to transfer information from the set top terminal 220 to the
statistical and billing sites.

10   5.   Set Top Terminal

The set top terminal 220 is the portion of the delivery
system 200 that resides in the home of a subscriber. The set
top terminal 220 is usually located above or below the
subscriber's television, but it may be placed anywhere in or
15   near the subscriber's home as long as it is within the range of
the subscriber's remote control device 900. In some aspects,
the set top terminal 220 may resemble converter boxes
already used by many cable systems. For instance, each set
top terminal 220 may include a variety of error detection,
20   decryption, and coding techniques such as anti-taping
encoding. However, it will become apparent from the
discussion below that the set top terminal 220 is able to
perform many functions that an ordinary converter box
cannot perform.

25   The set top terminal 220 has a plurality of input and
output ports to enable it to communicate with other local and
remote devices. The set top terminal 220 has an input port
that receives information from the cable headend 208. In
addition, the unit has at least two output ports which provide
30   communications from the set top terminal 220 to a television
and a VCR. Certain menu selections may cause the set top
terminal 220 to send control signals directly to the VCR to

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automatically program or operate the VCR. Also, the set top terminal 220 contains a phone jack which can be used for maintenance, trouble shooting, reprogramming and additional customer features. The set top terminal 220 may 5 also contain stereo/audio output terminals and a satellite dish input port.

Functionally, the set top terminal 220 is the last component in the delivery system chain. The set top terminal 220 receives compressed program and control 10 signals from the cable headend 208 (or, in some cases, directly from the operations center 202). After the set top terminal 220 receives the individually compressed program and control signals, the signals are demultiplexed, decompressed, converted to analog signals (if necessary) and 15 either placed in local storage (from which the menu template may be created), executed immediately, or sent directly to the television screen.

After processing certain signals received from the cable headend 208, the set top terminal 220 is able to store menu 20 templates for creating menus that are displayed on a subscriber's television by using an array of menu templates. Before a menu can be constructed, menu templates must be created and sent to the set top terminal 220 for storage. A microprocessor uses the control signals received from the 25 operations center 202 or cable headend 208 to generate the menu templates for storage. Each menu template may be stored in volatile memory in the set top terminal 220. When the set top terminal receives template information it demultiplexes the program control signals received from the 30 cable headend 208 into four primary parts: video, graphics, program logic and text. Each menu template represents a different portion of a whole menu, such as a menu

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background, television logo, cursor highlight overlay, or other miscellaneous components needed to build a menu. The menu templates may be deleted or altered using control signals received from the operations center 202 or cable

5   headend 208.

Once the menu templates have been stored in memory, the set top terminal 220 can generate the appropriate menus. In the preferred embodiment, the basic menu format information is stored in memory located within the set top

10   terminal 220 so that the microprocessor may locally access the information from the set top terminal instead of from an incoming signal. The microprocessor next generates the appropriate menus from the menu templates and the other menu information stored in memory. The set top terminal

15   220 then displays specific menus on the subscriber's television screen that correspond to the inputs the subscriber selects.

If the subscriber selects a specific program from a menu, the set top terminal 220 determines on which channel

20   the program is being shown, demultiplexes and extracts the single channel transmitted from the cable headend 208. The set top terminal 220 then decompresses the channel and, if necessary, converts the program signal to an analog NTSC signal to enable the subscriber to view the selected program.

25   The set top terminal 220 can be equipped to decompress more than one program signal, but this would unnecessarily add to the cost of the unit since a subscriber will generally only view one program at a time. However, two or three decompressors may be desirable to provide picture-on-

30   picture capability, control signal decompression, enhanced channel switching or like features.

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In addition to menu information. the set top terminal
220 may also store text transmitted from the cable headend
208 or the operations center 202. The text may inform the
subscriber about upcoming events. billing and account status.
5   new subscriptions. or other relevant information. The text
will be stored in an appropriate memory location depending
on the frequency and the duration of the use of the textual
message.

Also. optional upgrades are available to enhance the
10   performance of a subscriber's set top terminal 220. These
upgrades may consist of a cartridge or computer card (not
shown) that is inserted into an expansion slot in the set top
terminal 220 or may consist of a feature offered by the cable
headend 208 or operations center 202 to which the user may
15   subscribe. Available upgrades may include on line data base
services. interactive multi-media services. access to digital
radio channels. and other services.

In the simplest embodiment. available converter boxes
such as those manufactured by General Instruments or
20   Scientific Atlanta. may be modified and upgraded to perform
the functions of a set top terminal 220. The preferred
upgrade is a circuit card with a microprocessor which is
electronically connected to or inserted into the converter
box.

25   6.   Remote Control Device

The primary conduit for communication between the
subscriber and the set top terminal 220 is through the
subscriber interface. preferably a remote control device 900.
Through this interface. the subscriber may select desired
30   programming through the system's menu-driven scheme or
by directly accessing a specific channel by entering the actual
channel number. Using the interface. the subscriber can

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navigate through a series of informative program selection menus. By using menu-driven, iconic or alpha-character access, the subscriber can access desired programs by simply pressing a single button rather than recalling from memory and pressing the actual channel number to make a selection. The subscriber can access regular broadcast and basic cable television stations by using either the numeric keys on the remote control 900 (pressing the corresponding channel number), or one of the menu icon selection options.

In addition to enabling the subscriber to easily interact with the cable system 200, the physical characteristics of the subscriber interface 900 should also add to the user friendliness of the system. The remote control 900 should easily fit in the palm of the user's hand. The buttons of the preferred remote control 900 contain pictorial symbols that are easily identifiable by the subscriber. Also, buttons that perform similar functions may be color coordinated and consist of distinguishing textures to increase the user friendliness of the system.

7.   Menu-Driven Program Selection

The menu-driven scheme provides the subscriber with one-step access to all major menus, ranging from hit movies to sport specials to specialty programs. From any of the major menus, the subscriber can in turn access submenus and minor menus by cursor or alpha-character access.

There are two different types of menus utilized by the preferred embodiment, the Program Selection menus and the During Program menus. The first series of menus, Program Selection menus, consists of an Introductory, a Home, Major menus, and Submenus. The second series of menus, During Program menus, consists of two primary types, Hidden menus and the Program Overlay menus.

25

Immediately after the subscriber turns on the set top
terminal 220, the Introductory menu welcomes the
subscriber to the system. The Introductory menu may display
important announcements from the local cable franchise,
5   advertisements from the cable provider, or other types of
messages. In addition, the Introductory menu can inform the
subscriber if the cable headend 208 has sent a personal
message to the subscriber's particular set top terminal 220.

After the Introductory menu has been displayed the
10   subscriber may advance to the next level of menus, namely
the Home menu. In the preferred embodiment, after a
certain period of time, the cable system will advance the
subscriber by default to the Home menu. From the Home
menu, the subscriber is able to access all of the programming
15   options. The subscriber may either select a program directly
by entering the appropriate channel number from the remote
control 900, or the subscriber may sequence through
incremental levels of menu options starting from the Home
menu. The Home menu lists categories that correspond to
20   the first level of menus called Major menus.

If the subscriber chooses to sequence through
subsequent menus, the subscriber will be forwarded to the
Major menu that corresponds to the chosen category from
the Home menu. The Major menus further refine a
25   subscriber's search and help guide the subscriber to the
selection of his choice.

From the Major menus, the subscriber may access
several submenus. From each submenu, the subscriber may
access other submenus until the subscriber finds a desired
30   television program. Similar to the Major menu, each
successive level of Submenus further refines the subscriber's
search. The system also enables the subscriber to skip

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certain menus or submenus and directly access a specific menu or television program by entering the appropriate commands on the remote control 900.

The During program menus (including Hidden Menus
5   and Program Overlay Menus) are displayed by the set top terminal 220 only after the subscriber has selected a television program. In order to avoid disturbing the subscriber, the set top terminal 220 does not display the Hidden Menus until the subscriber selects the appropriate
10   option to display a Hidden Menu. The Hidden Menus contain options that are relevant to the program selected by the viewer. For example, a Hidden Menu may contain options that enable a subscriber to enter an interactive mode or escape from the selected program.

15   Program Overlay Menus are similar to Hidden Menus because they occur during a program and are related to the program being viewed. However, the Program Overlay Menus are displayed concurrently with the program selected by the subscriber. Most Program Overlay Menus are small enough on
20   the screen to allow the subscriber to continue viewing the selected program comfortably.

B.   Detailed Set Top Terminal Description

The set top terminal 220 receives and manipulates signals from the cable headend 208. The set top terminal
25   220 is equipped with local computer memory and the capability of interpreting the digitally compressed signal to produce menus for the subscriber. The remote control 900 communicates the subscriber's selections to the set top terminal 220. The subscriber's selections are generally based
30   upon menus or other prompts displayed on the television screen.

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It is preferred that the signal reaches the subscriber's home in a compressed format and is decompressed prior to viewing. Included in the delivered program signal is information that enables equipment at the subscriber's home
5   to display menus for choosing particular programs. Depending on the particular embodiment, the television program signal may arrive at the subscriber's home through one or more connections such as coaxial cables, fiber cables, twisted pairs, cellular telephone connections, or personal
10   communications network (PCN) hookups.

The program control information signal is generated by the operations center 202 and provides the network controller 214 with data on the scheduling and description of programs. In an alternate configuration, this data is sent
15   directly to the set top terminal 220 for display to the subscriber. In the preferred embodiment, the program control information signal is stored and modified by the network controller 214 and sent to the set top terminal 220 in the form of a set top terminal control information stream
20   (STTCIS). The set top terminal 220 integrates either the program control information signal or the STTCIS with data stored in the memory of the set top terminal 220 to generate on-screen menus that assist the subscriber in choosing programs for display.

25   The types of information that can be sent using the program control signal include: number of program categories, names of program categories, what channels are assigned to a specific category (such as specialty channels), names of channels, names of programs on each channel,
30   program start times, length of programs, description of programs, menu assignment for each program, pricing, whether there is a sample video clip for advertisement for

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the program, and any other program, menu or product information.

With a minimal amount of information being communicated to the set top terminal 220 on a regular basis,

5 the set top terminal 220 is able to determine the proper menu location for each program and the proper time and channel to activate for the subscriber after a menu selection. The program control information signal and STTCIS can be formatted in a variety of ways and the on-screen menus can

10 be produced using many different methods. For instance, if the program control information signal carries no menu format information, the menu format for creating the menus can be fixed in ROM at the set top terminal 220. In the preferred embodiment, the menu format information is

15 stored at the set top terminal 220 in a temporary memory device such as a RAM or EPROM. New menu format information is sent via the program control information signal or the STTCIS to the set top terminals 200 whenever a change to a menu format is desired.

20 In the simplest embodiment, the menu formats remain fixed and only the text changes. In this way the program control information signal can be limited to primarily text and a text generator can be employed in the set top terminal 220. Another simple embodiment uses a separate channel

25 full-time (large bandwidth) just for the menu information.

Live video signals may be used in windows of certain menus. These video signals can be transmitted using the program control information signal or STTCIS, or can be taken off channels being transmitted simultaneously with the

30 menu display. Video for menus, promos or demos may be sent to the set top terminal 220 in several formats, including (1) on a dedicated channel, (2) on a regular program channel

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and scaled to size, or (3) along with the program control
information signal. However, in the preferred embodiment, a
large number of short promos or demo video is sent using a
split screen technique on a dedicated channel. A multiple

5   window technique may be used with the menus to display a
description of a program and one or more video frames that
assist the subscriber in selecting the program.

Figure 4 shows the basic hardware components of the
set top terminal 220. The set top terminal 220 has a tuner

10   603. digital demodulator 606. decryptor 600. and
demultiplexers 609. 616 as well as audio equipment 612 and
a remote control interface 626 for receiving and processing
signals from the remote control unit 900. An optional
modem 627 allows communication between a microprocessor

15   602 and the cable headend 208. An NTSC encoder 625
provides a standard NTSC video output.

The microprocessor 602 is capable of executing
program instructions stored in memory. These instructions
allow a user to access various menus by making selections on

20   the remote control 900.

The manner in which the video is decompressed and
the menus are generated from the program control
information signal or STTCIS varies depending on the
specific embodiment of the invention. Video decompressors

25   618 and 622 may be used if the video is compressed. The
program control information signal may be demultiplexed
into its component parts, and a video decompressor 618.
graphic decompressor, text generator and video combiner
624 may be used to assist in creating the menus.

30   In addition to the menu format information that is
stored in graphics memory, the set top terminal 220 also
stores data, tracking those programs that have been selected

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for viewing. By gathering this data. the set top terminal 220 can maintain an accurate record of all programs accessed/watched by storing the data in EEPROM or RAM. Subsequently, this data can be transmitted to the cable

5   headend 208, where it can be used in carrying out network control and monitoring functions. Such data transmissions between the set top terminal 220 and cable headend 208 can be accomplished, for example. through upstream transmission over the cable network or over telephone lines

10   through the use of telephone modems. Where upstream transmission over the cable network is used. the set top terminals 220 can complete data transmissions on a scheduled (e.g.. using a polling response or status report to respond to polling requests sent from the cable headend

15   208) or as-needed (e.g.. using a random access technique) basis.

Figure 5a shows the front panel of the set top terminal 220, which includes an infrared sensor 630 and a series of LED displays 640. The LED displays 640 may indicate with

20   an icon or a letter (e.g. A-K) the major menu currently selected by the set top terminal 220 or the channels selected directly by a user, or menu channel selections (e.g.. from 1 to 50). Further displays may include current channel. time. volume level. sleep time. parental lock (security). account

25   balance. use of a hardware upgrade. second channel being recorded by VCR. use of the Level D music hardware upgrade in a separate room. and any other displays useful to a subscriber to indicate the current status of the set top terminal 220. The LEDs 640 may also provide an indication

30   of the digital audio channel currently tuned.

The set top terminal 220 includes a flapped opening 635 on its front that allows the insertion of a magnetic

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cartridge (or similar portable storage device, including optical disk, ROM, EPROM, etc. not shown). This cartridge opening 635 allows the set top terminal 220 to be upgraded or reprogrammed locally with the use of a magnetic tape

5   cartridge.

On the top or cover of the set top terminal 220 are located pushbutton controls 645. Any function that can be performed on the remote 900 may also be performed at the set top terminal 220 using the duplicative pushbutton

10   controls 645.

Figure 5b shows the back of the set top terminal 220, which includes a pair of output terminals 650, pair of input terminals 652, pair of stereo/audio output terminals 654, satellite dish input port 656, telephone jack 658 and an RS-

15   422 port 660. In addition, an upgrade port 662 and a cover plate 664 are held in place by a series of sheet metal screws. One of the output terminals 650 is for a television and the other is for a VCR. The set top terminal 220 is equipped to handle incoming signals on one or two cables using the input

20   terminals 652. The phone jack 658 and an RS-232 or RS-422 port 660 are provided for maintenance, trouble shooting, reprogramming and additional customer features. In alternate embodiments, the telephone jack 658 may be used as the primary mode of communication between the cable

25   headend 208 and the set top terminal 220. This connection is possible through the local telephone, cellular telephone or a personal communications network (PCN).

The basic programming of each set top terminal 220 is located on ROM within the set top terminal 220. Random

30   access memory, the magnetic cartridge capability, and the expansion card slot 635 each allow upgrades and changes to be easily made to the set top terminal 220.

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In the preferred embodiment, the set top terminal 220
includes a hardware upgrade port 662, in addition to
expansion card slots. The hardware upgrade port 662
accommodates a four-wire (or more) connection for: (1)

5   error corrected, decrypted data output of the set top
terminal 220, (2) a control interface, (3) decompressed video
output, and (4) a video input port. In the preferred
embodiment, multiple wires are used to perform each of the
four functions. The four sets of wires are combined in a

10   single cable with a single multipin connector.

In the preferred embodiment, multipin connections
may be used for the multiwire cable. The multipin
connection 662 may range from DB9 to DB25. A variety of
small computer systems interface (SCSI) ports may also be

15   provided. Alternatively, four or more ports may be provided
instead of the single port depicted.

Another port 662 is used to attach the various hardware
upgrades described below to a set top terminal 220. The
preferred embodiment has a number of hardware upgrades

20   available for use with a set top terminal 220, including: (1) a
Level A interactive unit, (2) a Level B interactive unit, (3) a
Level C interactive unit with compact disc capability, (4) a
Level D digital radio tuner for separate room use, and (5) a
Level E information download unit. Each of these upgrades

25   may be connected to the set top terminal 220 unit through
the upgrade port 662 described earlier. The same four wires
in a single cable described earlier may be used.

Existing set top converter boxes such as those made by
Scientific Atlanta or General Instruments are presently

30   unequipped to handle the menu selection system of the
present invention. Thus, hardware modifications are

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necessary in order to use the menu selection system with existing set top converter technology.

A Turbo Card addition to a set top converter is depicted in Figure 6. The Turbo Card 700 shown provides the additional functionality needed to utilize the menu system with existing set top converter technology. The primary functions the Turbo Card 700 adds to the set top converter are the interpreting of program control information signals, generating of menus, sequencing of menus, and, ultimately, the ability of the viewer to select a channel through the menu system without entering any channel identifying information. The turbo card also provides a method for a remote location, such as the cable headend 208, to receive information on programs watched and control the operation of the set top converter and Turbo Card 700. The programs watched information and control commands may be passed from the cable headend 208 to the Turbo Card 700 using telephone lines.

The primary components of the Turbo Card 700 are a PC chip CPU 702, a VGA graphic controller 704, a video combiner 706, logic circuitry 708, NTSC encoder 710, a receiver 712, demodulator 714, and a dialer 716. The Turbo Card 700 operates by receiving the program control information signal from the cable headend 208 through the coaxial cable. The logic circuitry 708 of the Turbo Card 700 receives data, infrared commands, and synchronization signals from the set top converter. Menu selections made by the viewer on the remote control 900 are received by the set top converter's IR equipment and passed through to the Turbo Card 700. The Turbo Card 700 interprets the IR signal and determines the program (or menu) the viewer has selected. The Turbo Card 700 modifies the IR command to

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send the program selection information to the set top converter 221. The modified IR command contains the channel information needed by the set top converter. Using the phone line and dialer 716, the Turbo Card 700 is able to

5 transmit program access information to the cable headend 208.

In the preferred embodiment. program access information, that is what programs the viewer watched, is stored at each set top terminal 220 until it is polled by the

10 network controller 214 using a polling request message format as shown in Figure 7a. This frame format 920 consists of six fields. namely: (1) a leading flag 922 at the beginning of the message. (2) an address field 924. (3) a subscriber region designation 926. (4) a set top terminal identifier 928 that

15 includes a polling command/response (or P/F) bit 930. (5) an information field 932. and (6) a trailing flag 934 at the end of the message. Figure 7b shows a response frame format 920' (similar to the frame format 920 end. therefore, commonly numbered with the frame depicted in Figure 7a. but with the

20 prime indicator added for clarity) for information communicated by the set top terminal 220 to the network controller 214 in response to the polling request of Figure 7a.

The eight-bit flag sequence 922 that appears at the beginning and end of a frame is used to establish and

25 maintain synchronization. Such a sequence typically consists of a "01111110" bit-stream. The address field 924 designates a 4-bit address for a given set top terminal 220. The subscriber region designation 926 is a 4-bit field that indicates the geographical region in which the subscriber's

30 set top terminal 220 is housed. The set top terminal identifier 928 is a 16-bit field that uniquely identifies each set top terminal 220 with a 15-bit designation followed by an

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appended P/F bit 930. Although field size is provided by this example. a variety of sizes can be used with the present invention.

5   The P/F bit 930 is used to command a polling response from the set top terminal 220 addressed. as described below. The response frame format 920' also provides a variable-length information field 932' for other data transmissions. such as information on system updates. The frame format 920' ends with an 8-bit flag (or trailing flag) 934' that is

10   identical in format to the leading flag 922'. as set forth above. Other frame formats (e.g.. MPEG) will be apparent to one skilled in the art and can be easily adapted for use with the system.

As summarized above. images or programs may be

15   selected for display by sequencing through a series of menus. Figure 8 is an example of one possible structure for a series of menus. Generally. the sequence of menus is structured with an introductory menu. a home menu. various major menus and a multitude of submenus. The submenus can include

20   promo menus and during program menus. For example. at the home menu portion of the sequence of menus and corresponding software routines. a subscriber may select one of the major menus and start a sequence of menu displays. Alternatively. a subscriber may go directly to a major menu by

25   depressing a menu select button on remote control 900.

At any time during the menu sequence. the subscriber may depress a major menu button to move into another series of menus. In this way. a subscriber may move from major menu to major menu.

30   The various software subroutines executed by the microprocessor 602 allow a subscriber to sequence the menus. navigating through the various menus of the present

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invention. A subscriber may sequence back through menus or return to the home menu with a single touch of the home menu button on remote 900.

5   An introductory menu screen 1000 automatically appears upon power-up and initialization of the set top terminal 220. From this introductory menu screen 1000, the set top terminal software will normally advance the subscriber to the home menu screen 1010. The home menu 1010 is the basic menu that the subscriber will return to in 10   order to make the first level of viewing decisions. When the set top terminal software is displaying the home menu 1010, the subscriber is able to access any television programming option. The software allows programming options to be entered through cursor movement on the screen and directly 15   by button selection on the remote control 900.

In the normal progression through the menu screens, the software will forward the subscriber to a major menu screen 1020 in response to the subscriber's remote control 900 selection or highlighted cursor selection from the home 20   menu screen 1010. The selections displayed on the home menu 1010 are for large categories of programming options.

Following the major menu 1020, the subscriber may navigate through one or more submenu screens 1050 from which the subscriber may choose one particular program for 25   viewing. For most programming selections, the user will proceed from the home menu 1010 to a major menu 1020 and then to one or more submenus 1050. However, for certain programming options or functions of the set top terminal 220, the user may skip one or more menus in the 30   sequence.

The During Program Menus 1200 are submenus enabled by the set top terminal software only after the

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subscriber has selected a television program. These menus provide the subscriber with additional functionality and/or additional information while viewing a selected program. The During Program Menus 1200 sequence can be further
5   subdivided into at least two types of menus. Hidden Menus 1380 and Program Overlay Menus 1390.

To avoid disturbing a subscriber during viewing of a program, the Hidden Menus 1380 are not shown to the subscriber but instead "reside" at the set top terminal 220
10   microprocessor 602. The microprocessor 602 awaits a button entry either from the remote control 900 or set top terminal 220 buttons before executing or displaying any Hidden Menu 1380 options. The set top terminal software provides the subscriber with additional functions such as
15   entering an interactive mode or escaping from a selected program through use of Hidden Menus 1380.

Program Overlay Menus 1390 are similar to Hidden Menus 1380. However, the Program Overlay Menus 1390 are overlayed onto portions of the displayed video and not
20   hidden. The software for the Program Overlay Menus 1390 allows the subscriber to continue to watch the selected television program with audio but places graphical information on a portion of the television screen. Most Program Overlay Menus 1390 are graphically generated to
25   cover small portions of video. Some Overlays 1390 which are by their nature more important than the program being viewed will overlay onto greater portions of the video. Examples of types of overlay menus 1390 include Notification Menus 1392 and Confirmation Menus 1394. In the preferred
30   embodiment, the software for the Program Overlay Menus 1390 controls the reduction or scales down the (entire)

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programs video and redirects the video to a portion of the
screen.

Submenus provide the cost of viewing the program and
the program's length in hours and minutes. From the
5   submenus, the subscriber is given at least three options: (1)
to purchase a program, (2) to return to the previous menu,
and (3) to press "go" and return to regular TV. The
subscriber may also be given other options such as previewing
the program.

10   Using an on-screen menu approach to program
selection, there is nearly an unlimited number of menus that
can be shown to the subscriber. The memory capability of the
set top terminal 220 and the quantity of information that is
sent using the program control information signal are the
15   only limits on the number of menus and amount of
information that can be displayed to the subscriber. The
approach of using a series of menus in a simple tree sequence
is both easy for the subscriber to use and simply implemented
by the set top terminal 220 and remote control device 900
20   with cursor movement. A user interface software
programmer will find many obvious variations from the
preferred embodiment described.

The set top terminal 220 generates and creates menus
using, in part, information stored in its graphics memory. A
25   background graphics file 800 will store menu backgrounds
and a logo graphics file will store any necessary logos. A
menu display and cursor graphics file will store menu display
blocks and cursor highlight overlays as well as any other
miscellaneous files needed to build the menus. Using this
30   method of storing menus, the menus can be changed by
reprogramming the graphics memory of the set top terminal

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220 through instructions from either the network controller 214 or operations center 202.

The microprocessor 602 performs the steps required to create a menu using stored information. The

5   microprocessor 602 fetches a background file. logo file. menu display and cursor file in most instances. The microprocessor 602 fetches text from long-term. intermediate-term. or short-term storage depending on where the text is ·stored. Using a video combiner (or like device). the stored

10   information is combined with video and the entire image is sent to the television screen for display.

In the preferred embodiment. a graphics controller is used to assist the set top terminal 220 in generating menus. Menu generation by the set top terminal 220 begins with the

15   building of a major menu screen. which includes background graphics for that major menu. The background graphics may include an upper sash across the top of the screen and a lower sash across the bottom of the screen. The background graphics may be generated from the background graphics file

20   800 in the memory files of the graphics memory (preferably EEPROM). In addition. logo graphics may be generated. Such graphics typically include an icon window. a cable company logo. a channel company logo. and two "go" buttons.

Preferably. the text for each major menu is generated

25   separately by a text generator in the set top terminal 220. Those portions of the text that generally remain the same for a period of weeks or months may be stored in EEPROM or other local storage. Text which changes on a regular basis. such as the movie titles (or other program selections). is

30   transmitted to the set top terminal 220 by either the operations center 202 or the network controller 214 of the cable headend 208. In this manner. the cable headend 208

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may change the program selections available on any major menu 1020 by modifying the program control information signal sent by the operations center 202 and transmitting any changes using the STTCIS.

5   Day, date and time information are added to each major menu. This information is sent from the operations center 202, the cable headend 208 (signal processor 209 or network controller 214), the uplink site, or generated by the set top terminal 220 internally.

10   The creation and display of program description submenus is performed by the set top terminal 220 in a manner similar to that described above. Each submenu may be created in parts and combined before being sent to the television screen. Preferably, background graphics and upper

15   and lower sashes are used. Likewise, a video window and half-strip window can be generated from information in storage on the EEPROM.

In addition to graphics and text, some submenus include windows that show video. Such video may be still or

20   moving pictures. Still pictures may be stored in a compressed format (such as JPEG) at the set top terminal 220. Video stills may be transmitted by the operations center 202 through the program control information signal from time to time.

25   Moving video picture is obtained directly from a current video feed as described above. Depending on video window size, this may require manipulation of the video signal, including scaling down the size of the video and redirecting the video to the portion of the menu screen which is within

30   the video window of the menu. Alternatively, the video may be obtained from a split screen channel. Such a method involves the use of split screen video techniques to send

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multiple video clips on a single channel at a given time. The set top terminal 220 would scale the picture, if necessary, and redirect it to the correct position on the screen using known scaling and positioning techniques. Additional

5   circuitry may be required in the set top terminal 220 to perform adequate scaling and repositioning.

To avoid the need for redirecting video into the portion of the screen which houses the video window, masking and menu graphics may be used to cover the portions of the

10   channel video that are not needed. This masking technique allows the split screen video to remain in the same portion of the screen that it is transmitted by the operations center 202. The masking is then adjusted to cover the undesired portions of the screen. These masks are stored in the

15   background graphics file similarly to other background files for menus.

The split screen video technique may also be used for promoting television programming. Since a great number of short video clips may be sent continuously, full or partial

20   screen promotionals (or informationals) may be provided to the subscriber. With this large quantity of promotional video, the subscriber is given the opportunity to "graze" through new movie or television programming selections. The subscriber simply grazes from promotional video to

25   promotional video until the desired television program is discovered.

C.   Detailed Description of Advanced Set Top
      Terminal

30   1.   Overview

The present invention relates to advances in the set top terminal 220 described above. In particular, the present invention may be achieved through a set of hardware

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upgrades or additions to the following embodiments: (1) an existing set top converter (not shown) upgraded with a Turbo Card 700 or the like: (2) an industry standard digital decompression converter box (as shown in Figures 9a and 9b

5   below) upgradeable by either an upgrade module or a menu generation card: or (3) a set top terminal 200 capable of both decompression and menu generation. The set of hardware upgrades described below can be used to provide additional advanced features and functional capabilities to any of these

10   embodiments.

Table A shows several exemplary hardware configurations that may be used to achieve the goals of the present invention. In particular, Table A shows four columns of set top converter technology. which may be modified to

15   produce the various set top capabilities shown in the three rows of the table.

TABLE A

	Existing Analog Set Top Converter	Set Top Converter With Digital Decompression Capability	Set Top Converter With Digital Decompression and Menu Generation Capabilities	Advanced Set Top Terminal
Decompression Capability	N/A	Built-In	Built-In	Built-In
Menu Generation Capability	Turbo Card	Upgrade Module or Menu Generation Card	Built-In	Built-In
Advanced Features	Level A-C Hardware Upgrades or Expansion Card	Level A-E Hardware Upgrades or Expansion Card	Level A-E Hardware Upgrades or Expansion Card	Built-In

The table shows the various inherent functional

35   capabilities of each set top converter. and how each may be modified or upgraded. if necessary, to achieve the objectives of the present invention. From left to right. the columns of the table span the various alternatives for balancing those capabilities that may be built into set top converters or

40   terminals. on the one hand. and those capabilities that can be provided through. for example. an upgrade module.

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expansion card or hardware upgrade of the present invention, on the other. This balance allows a designer or manufacturer of set top converters to choose between adding advanced functionality to an existing converter box or, instead,

5   producing a converter with additional built-in features that increase cost and complexity of the converter or terminal.

The first column of Table A shows how an existing analog set top converter can be modified to provide menu generation capability through the use of the Turbo Card. In

10   addition to the Turbo Card, such an existing analog set top converter may be further modified to provide any of the advanced features described below through the use of the Level A, Level B and Level C hardware upgrades or an expansion card. Such existing set top converter boxes are

15   currently manufactured by Scientific Atlanta and General Instruments, among others. These converter boxes have been designed for use with analog waveforms and, as a result, digital decompression capabilities are not applicable.

The second column of Table A shows a set top

20   converter with digital decompression capability. This converter is a simple decompression box which may eventually become the industry standard. The simple decompression boxes may be modified to provide the enhanced functionality of the present invention. For

25   example, a simple decompression box may be modified to produce menu generation capability through the use of an upgrade module or menu generation card. In addition, other advanced features may be added to a simple decompression box through modifications that include any of the Level A

30   through E hardware upgrades or an expansion card. Each of these modifications are described below.

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The third column of Table A shows a set top converter that has built-in digital decompression and menu generation capabilities. Thus, in order to achieve the enhanced functionality of the present invention, other advanced

5   features may be provided through hardware modification. Such modification may be accomplished through the use of any of the Level A through E hardware upgrades or the expansion card, as explained below.

The fourth column of Table A shows an advanced set

10   top terminal having decompression, menu generation, and advanced functional capabilities. Each of these capabilities are built in to the terminal itself. In this way, achieving the enhanced performance of the set top terminal in accordance with the present invention would require no hardware

15   modification.

In the preferred embodiment, the advanced set top terminal 220 of the present invention has the capability, among other things, of receiving tiered programming from the network controller. Tiered programming allows different

20   users to view different video even though the subscribers are "tuned" to the same channel. For example, the network controller 214 may know the demographics of its subscribers through a database, by "learning" from prior subscriber choices, from an interactive selection, or from other means.

25   Using the demographics information, the network controller 214 may target commercials to the correct audience by showing different commercials to subscribers with different demographics. Even though subscribers will believe they are "tuned" to one channel, each subscriber will be switched to a

30   different channel for the tiered video. Alternatively, subscribers may be offered an option of several commercials from which to choose.

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To accommodate foreign speaking subscribers, multiple audio channels for television programming may be provided. In this way, the subscriber may be shown menus of programs available in the subscriber's native language. The function of choosing the correct audio to correspond to the selected language may be handled by either the set top terminal 220 or the network controller 214 depending upon the configuration. Local programming in several languages or additional audio channels for a foreign language translation of a popular television program may be provided by the network controller 214. Using a picture-on-picture feature, sign language may be similarly made available to certain set top terminals 220 for the deaf. Also, a text overlay may easily be produced on the lower part of the screen for the deaf.

Typically, each video signal is received at the set top terminal 220 along with four audio channels. Two of these audio channels will preferably be used for left and right stereo audio reception of the video signal being displayed. The remaining two audio signals may be used for alternative languages. For example, where a video signal is received by the set top terminal 220, two of the audio channels will provide the stereo audio signals for that video in English, with the other two audio channels providing mono audio signals in French and Spanish. In this way, each video signal received at the set top terminal 220 can accommodate at least two foreign languages. Where stereo audio channels are not desired, the audio channels in English can be set to a single signal, providing mono audio reception, and increasing the multiple language audio channel capability to three foreign languages.

In other embodiments, the network controller 214 can act as a central computer and provide intra-set top terminal

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interactive games, inter-set top terminal interactive games, computer bulletin board type services, message services (Electronic mail) etc. For example, a subscriber may play war games with five (anonymous) fellow subscribers each in their

5   own home each operating a separate tank. The network controller 214 gathers the players via set top terminal 220 communications and acts as the referee. A bulletin board or message system can be set up to discuss a particular program such as "Twin Peaks Whodunit" for enthusiasts. These

10   interactive features are further described below with the interactive services level B menu and the set top terminal hardware upgrade level B interactive unit.

In order to achieve the required throughput of video and audio information for the system, digital compression

15   techniques for video are employed. As a result, the set top terminal 220 typically must decompress any digitally compressed program signals that it receives. Methods of decompression are a function of the compression technique used in the program delivery system.

20   There are three basic digital compression techniques: within-frame (intraframe), frame-to-frame (interframe), and within-carrier compression. Various compression methods may be used with these techniques. Such methods of compression, which include vector quantization and discrete

25   cosine transform methodologies, are known to those skilled in the art.

Several standard digital formats representing both digitizing standards and compression standards have also been developed. For example, JPEG (joint photographic

30   experts group) is a standard for single picture digitization. Motion picture digitization may be represented by standards such as MPEG or MPEG 2 (motion picture engineering group

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specification). In addition to these standards, other proprietary standards have been developed. Although MPEG and MPEG 2 for motion pictures are preferred in the present invention, any reliable digital format with compression may

5   be used.

Various hybrids of the above compression techniques and methods have been developed by several companies including AT&T. Compression Labs. Inc.. General Instruments. Scientific-Atlanta. Philips. and Zenith. Any of

10   the compression techniques developed by these companies, as well as other techniques known to those skilled in the art, may be used with the present invention.

2.   Advanced Set Top Terminal Major Components and Upgrades

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a   Decompression Box with Upgrade Module

The preferred program delivery system uses digitally

20   compressed signals and, as a result, the preferred subscriber equipment configuration must be capable of decompressing and processing such digitally compressed signals. Figure 9a diagrams the basic interplay between an upgrade module 700 and a simple decompression box 302. The upgrade module

25   300 can be connected to the decompression box 302 through a port similar to the upgrade port 662 described above (Figure 5b). The simple decompression box 302 shown is preferably a future industry standard decompression box capable of communicating with an upgrade module 300 to

30   enhance functionality.

The upgrade module 300 provides menu generation capability to the simple decompression box 302. The microprocessor of the simple decompression box 302 communicates with the microprocessor in the upgrade

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module 300 to provide the full functionality of a set top terminal 220.

In the preferred embodiment, multipin connections may be used for a multiwire cable connecting the simple decompression box 302 with the upgrade module 300. The multipin connection may range from DB9 to DB25. A SCSI, or small computer systems interface, port (not shown) may also be provided. Alternatively, four or more ports may be provided instead of the single port depicted. If a port is not provided, the upgrade module may, alternatively, be hard-wired to the simple decompression box 302.

As represented generally at 304, the digital data set of output wires of the simple decompression box 302 will preferably output error corrected and decrypted data to the upgrade module 300. The second set of wires, providing the interface connection, allows the microprocessor in the upgrade module 300 to communicate with the microprocessor of the simple decompression box 302. In this manner, the video circuitry of the upgrade module 300 and the simple decompression box 302 may maintain synchronization. The third set of wires, providing the decompressed video output, provide the upgrade module 300 with a decompressed video signal to manipulate. The fourth set of wires, comprising the video input set, allows the simple decompression box 302 to accept a video signal that is a combined text, graphics, and video signal.

Figure 9a further shows the CATV input 306, video input 308, and video and audio outputs 310, 312, as part of the simple decompression box 302. This embodiment reduces the component cost of upgrade module 300, and thus, is preferred. The upgrade module 300 may simply be a cartridge (not shown) insertable into the simple

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decompression box 302. Alternatively, as shown in commonly numbered Figure 9b, the CATV input 306, video input 308 and video and audio outputs 310, 312 may be included as part of the upgrade module 300. In this
5   embodiment, the simple decompression box 302 is primarily used for decompressing the video.

Referring to Figure 10, the upgrade module 300 preferably includes the following circuitry: a video graphics and text demultiplexer 314; a text and graphics video plane
10   combiner 316; a run length graphics decompressor 318; and, a run length compressed graphics memory 320 (nonvolatile RAM, ROM, EPROM, or EEPROM). By means of communications through the multiwire connection between the upgrade module 300 and the simple decompression box
15   302, compressed video and control signals may be demultiplexed by the demultiplexer 314 within the upgrade module 300. The run length graphics decompressor 318, through communications with the run length compressed graphics RAM 320, permits decompression of the input
20   compressed video signal. The text and graphics video plane combiner 316 allows demultiplexed and decompressed signals to be output, through the simple decompression box 302, to a subscriber's television 222 showing both video and overlay menus with text.
25   Figure 10 shows the elements of a simple decompression box 302 (numbered commonly with the elements of the set top terminal 220 depicted in Figure 4) with the upgrade module 300 described above. Generated menus and video are combined in the combiner 316 and
30   output to an antitaping encoder 619. Any method of antitaping encoding known by those skilled in the art may be used with the present invention.

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Figure 10 also depicts an expansion card 320 and an
expansion card interface 320 for receiving the card 320. In
addition, error correction circuitry 324 is shown receiving
the demodulated signal, prior to demultiplexing the signal.

5   The enhanced functionality of the upgrade module 300
may alternatively be included on the expansion card 320. In
this embodiment, the upgrade module 300 becomes an
internal component of the simple decompression box 302
and internally upgrades the box 302 to include menu
10   generation capability without using an external hardware
upgrade module 300. Other variations in the upgrade module
300 configuration are also possible.

b.   Upstream   Data   Transmission
Hardware

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Figure 11 shows a preferred set top terminal 220 that
includes a data receiver 332 and a data transmitter 344. The
data transmitter 344 provides upstream data communications
capability between the set top terminal 220 and the cable
20   headend 208.   Upstream data transmissions are
accomplished using the polling system described with
reference to Figures 7a and 7b above, and, in particular, using
a data transmitter 344. Both receiver 332 and transmitter
344 may be built into the set top terminal 220 itself or added
25   through an upgrade module 300. Regardless of the specific
hardware configuration, the set top terminal's data
transmission capabilities may be accomplished using the
hardware shown in Figure 11.

Figure 11 shows RF signals, depicted at 330, being
30   received at by a data receiver 332 and tuner 603 working in
unison.   Both of these devices are interfaced with the
microprocessor 602, which receives inputs, depicted at 338,
from the subscriber, either through the set top terminal's

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keypad 645 or remote control unit 900. All cable signals intended for reception on the subscriber's TV are accessed by the tuner 603 and subsequently processed by the processing circuitry 340. This processing circuitry 340

5   typically includes additional components for descrambling. demodulation. volume control and remodulation on a Channel 3 or 4 TV carrier.

Data targeted to individual set top terminals 220 is received by the data receiver 332 according to each set top

10 terminal's specific address or ID (e.g. set top ID 928. 928'). In this way. each addressable set top terminal 220 only receives its own data. The data receiver 332 may receive set top terminal specific data in the information field of the program control information signal frame described with

15 reference to Figure 7a or on a separate data carrier located at a convenient frequency in the incoming spectrum.

Any received data includes information regarding channels and programs available for selection. The subscriber may enter a series of commands using the keypad 645 or

20 remote control 900 in order to choose a channel or program. Upon receipt of such commands. the set top terminal's microprocessor 602 instructs the tuner 603 to tune to the proper frequency of the channel or program desired and subsequently instructs the processing circuitry 340 to begin

25 descrambling of this channel or program.

Upon selection of a channel or program. the microprocessor 602 stores any selection information in local memory for later data transmission back to the cable headend 208. Typically. the data transmitter 344 operates in the

30 return frequency band between 5 and 30 MHz. In an alternative embodiment. the frequency band of 10 to 15 MHz may be used. Regardless. however. of the frequency band

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used. the data transmitter 344 sends information to the cable
headend 208 or network controller 214 in the information
field of the frame described with reference to figure 7b.
Those skilled in the art will recognize that a number of
5   variations and combinations of the above-described set top
terminal 220 hardware components may be used to
accomplish upstream data transmissions.

     c.   Hardware Upgrades

     In order to enhance a set top terminal's 220
10   functionality. the following hardware upgrades may be used:
(1) a Level A interactive unit. (2) a Level B interactive unit.
(3) a Level C interactive unit with compact disc capability.
(4) a Level D digital radio tuner for separate room use. and
(5) a Level E information download unit. Each of these
15   upgrades is connected to the set top terminal 220 unit
through the upgrade port 662 described earlier.

     Level A. B and C hardware upgrades have similar
hardware components. Figure 12a diagrams the basic
components of the Level A. B and C hardware upgrades.
20   indicated generally at 100. The figure diagrams the
interaction between the hardware upgrades 100 and the set
top terminal's 220 basic components. As seen in the figure.
CATV input signals are received by the set top terminal 220
using a tuner 603 and various receiver components described
25   above (but denoted generally at 601 in Figures 12a and 12b).
The set top terminal's microprocessor coordinates all CATV
signal reception and also interacts with various upstream data
transmission components 604. which have been described
above.

30   The Level A. B and C hardware upgrades 100 each
include a microprocessor 104. interactive software 106.
processing circuitry 108. bubble memory 112. and a long-

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term memory device 116. In addition to these basic components. the Level B hardware upgrade makes use of an additional telephone modem 120, while the Level C hardware upgrade makes use of an additional CD-ROM storage device 122.

5

Along with their basic components. the Level A. B and C hardware upgrades 100 each use their own interactive software 106. This software may be used to provide the enhanced functional capabilities described below. The Level A. B and C hardware upgrades also make use of processing circuitry 108. which allows the set top terminal 220 to pass the subscriber's interactive input to the Level A. B and C hardware upgrades 100 for interpretation. These commands are passed through the interface linking the set top terminal's microprocessor with the microprocessor of the Level A. B and C hardware upgrades 100. In this way. subscriber inputs. entered through the set top terminal keypad or remote control. can be transferred to any of the hardware upgrades for processing and responses generated therein can then be sent back to the set top terminal 220 for display. In the preferred embodiment the IR commands are transferred from set top terminal to hardware upgrade.

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The Level A. B and C hardware upgrades 100 also include a long-term memory component or device 116 that allows each hardware upgrade to internally store data used with each interactive service. Such data may include. for example. customized menu templates used by the individual interactive services. In addition. the Level A. B and C hardware upgrades include a bubble memory 112 for the temporary storage of. for example. interactive questions and responses used in each particular interactive service.

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The Level A interactive unit allows the subscriber to access interactive services offering additional information about programs such as quizzes, geographical facts, etc. This information may be received by the set top terminal 220 in several data formats, including using the vertical blanking interval (VBI) or the program control information signal. The Level A interactive unit enables the subscriber to engage in textual interactivity with the current television program using overlay menus. Some examples are quizzes, fast facts, more info, where in the world, products, etc. all of which provide the subscriber with an interactive question and answer capability. Although the Level A interactive capability can easily be built into the set top terminal 220, such an embodiment increases the cost of the basic set top terminal 220.

The Level B interactive unit provides the user with access to online data base services for applications such as home shopping, airline reservations, news, financial services, classified advertising, home banking, and interactive teletext services. For example, with this upgrade, a user will be able to reserve plane tickets or buy consumer electronics. The primary feature of this upgrade unit is that it allows actual transactions using two-way communications over modem with outside services. This added two-way communications capability may be with the cable headend 208 or, alternatively, over cellular networks, PCN or other communications media.

The Level C interactive unit employs a high volume local storage capacity, including compact disc or other random access digital data formats (e.g., CD-ROM 122). This unit allows use of interactive multi-media applications. Such applications include, for example, computer games, multi-

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media educational software. encyclopedias. other reference volumes (e.g. Shakespeare library). etc. In the preferred embodiment. many of these applications will interact with live programming providing additional information and interactivity to the basic program feed. For example. a viewer watching a show set in a foreign country may be able to retrieve additional information. maps. economic data. as well as other information about that country that are stored on the compact disc. In the Level C applications. the upgrade hardware may closely monitor the television broadcast through additional data channels (e.g.. vertical blanking interval. or other digital data encoded within live video) providing context sensitive interactivity.

Figure 12b diagrams the interaction between the set top terminal 220 and the Level D hardware upgrade. indicated generally at 130. As shown in the figure. the CATV signals are input to the set top terminal 220 through its tuner 603 and receiver components 601. As described above. the microprocessor 602 coordinates all cable television signal reception by the set top terminal 220. The Level D hardware upgrade 130 makes use of a microprocessor 132. a tuner 134. a demodulator 136. a demultiplexer 138. a decryptor 140 and an audio decompressor 142.

As shown in the figure. the set top terminal 220 and the Level D hardware upgrade 130 interact through the interface linking the respective devices. The set top terminal's microprocessor 602 instructs received signals to be transferred to the Level D hardware upgrade 130 for further processing. These received signals are input to the Level D hardware upgrade. passed through the signal path comprising the tuner 134 and other digital audio reception components (i.e.. demodulator 136. demultiplexer 138.

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decryptor 140 and audio decompressor 142). Through the
use of the hardware as configured in Figure 12b, the
subscriber can select a digital audio program for listening.
The subscriber can accomplish such selection through a
5   subscriber interface (not shown), which may exist at the set
top terminal 220 or, alternatively, at the Level D hardware
upgrade.

The Level D hardware upgrade allows the subscriber
separate access to the digital radio channels while other
10   programming (not necessarily radio) is being viewed on the
television. Typically, this upgrade would be used for digital
radio usage in a separate room from that of the television.
The upgrade has a separate tuner, decompressor, and visual
display.   In the preferred embodiment a second remote
15   control (which is preferably a scaled-down version of the set
top terminal remote control, described below) is provided to
access the digital audio system. This remote is equipped
with a display.

The Level E hardware upgrade allows the subscriber to
20   download large volumes of information from the operations
center 202 or cable headend 208. The Level E hardware
upgrade will enable subscribers to download data, such as
books and magazines, to local storage. Primarily, the Level E
hardware upgrade is an additional local storage unit (e.g.,
25   hard disk, floppy, optical disk or magnetic cartridge).
Preferably, a small portable reader, called "EveryBook™", is
also provided with the upgrade to enable downloaded text to
be read without the use of a TV. The portable reader is
equipped with a screen.

30   The downloadable information may be text or video
supplied by the operations center 202 or cable headend 208.
With this upgrade, books may be downloaded and read

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anywhere with the portable reader. Using this upgrade. video may be downloaded and stored in compressed form for later decompression. The video would be decompressed only at the time of viewing. Important text that the public desires

5   immediate access may made available through this system. Text such as the President's speech. a new law. or a recent abortion decision rendered by the Supreme Court may be made immediately available.

Using a more sophisticated port. such as the SCSI port.

10   multiple hardware upgrade units may be connected. or "daisy-chained" together. to operate simultaneously. Although these upgrade units are described separately. the units may be combined or built into the set top terminal 220. Those skilled in the art will recognize variations on such

15   combinations of and additions to the set top terminal hardware.

d.   Expansion Card Slot

In order to provide the greatest flexibility possible and prevent a set top terminal 220 from becoming outdated

20   during the terminal's useful life. additional electronic expansion card slots have been built into the preferred embodiment. The expansion slots 665 (depicted in phantom in Figure 5b) are covered by the metal plate cover 664 as shown in Figure 5b. It is anticipated that additional memory

25   or capabilities may be needed for certain customer features and also to update the system as the cable delivery system's capabilities increase.

In addition to providing an additional memory capability. the expansion card slot provides an easy method to

30   upgrade the set top terminal hardware. In particular. expansion cards can be used to internally provide any of the Level A through E hardware upgrade features described above.

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Such embodiments. however. use the upstream data transmission hardware. also described above (or built-in modem).

Functionally. the expansion card (not shown) may be
5   inserted into an expansion card slot 665. causing the connector on the expansion card to electrically link with a connector on the set top terminal 220. Preferably. the frame of the set top terminal has a shelf or rack position to hold the expansion card. The connector on the set top terminal 220
10   may simply be an electrical connection to the set top terminal's microprocessor and/or memory device or devices. Alternatively. the interface between the expansion card and the set top terminal 220 may be an electrical bus that allows the memory resources of the set top terminal 220 to be
15   directly expanded. In this case. the expansion card itself contains a memory device or devices that expand the amount of program information or data that the set top terminal 220 may access. Such memory devices include RAM. ROM. EPROM or EEPROM. In addition. the interface may be a
20   "mailbox." which resides in the set top terminal 220 as a single memory location. This embodiment facilitates the transfer of data between the set top terminal 220 and the expansion card in either serial or parallel format. Such transfers are coordinated and controlled by the set top
25   terminal's microprocessor 602.

The use of expansion cards lowers the cost of the set top terminal 220 itself. while also increasing its potential functionality. Thus. an expansion card may include enhanced functional capabilities described as part of the upgrade
30   module discussion above and be designed to accommodate any hardware upgrade compatible with the set top terminal 220.

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3.   Remote Control and Subscriber Access of
      Set Top Terminal

        The subscriber can access programs televised by the
5   system through the set top terminal 220 using a remote
        control 900. Figure 13a shows a two-section remote control
        900 that accommodates such access. To reduce costs and
        make the set top terminal 220 as user friendly as possible. a
        standard television remote control 350, such as a Jerrold RC
10   650 remote control or the like. may be augmented by adding
        a new section 352 that provides the additional digital menu
        access and ordering functions. Figure 13a depicts the
        addition of menu access and cursor movement control to the
        remote control 900.

15   The remote control 900 has an ordering button 354
        and four-way cursor movement 356 that includes a "go"
        button 358 and menu access buttons 360. The preferred
        remote control 900 operates using infrared (IR) signals. with
        the signals being received by the infrared (IR) sensor 630 on
20   the front of the set top terminal 220.

        In the simplest embodiment. the remote 900. may be
        built with only cursor movement and a go button. In more
        sophisticated embodiments. the remote control 900 may be
        provided with buttons that are programmable to perform
25   specific functions for a series of entries. An intelligent or
        smart remote control 900 would increase both the cost and
        capability of the set top terminal 220 system. Using the
        augmented remote control 900 depicted in Figure 13a. a
        subscriber can navigate the program menu system of the set
30   top terminal 220.

        Figure 13b shows an alternative and preferred
        embodiment of the remote control 900 for use in the present
        invention. Standard television receiver remote control

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switches or buttons 362 may be used, including volume
control, channel select, power and signal source buttons, as
well as other menu buttons 364, including cursor movement,
cursor select, menu select, and pay television buttons
5   arranged longitudinally on the remote control 900, as
opposed to the width-wise separation, as shown in Figure
13a. The color of the buttons or the surrounding background
may differ between the standard television remote control
buttons 362 and the menu buttons 264 to differentiate
10   visually between these two groups of buttons.

The width and depth of the remote control unit 900
are considerably less than the length to allow the remote
control unit 900 to fit easily within a user's palm. The
remote control unit 900 preferably has its center of mass
15   balanced substantially near the longitudinal middle. This
balance allows a user's thumb to naturally be placed in
substantially the middle portion of the remote control unit
900, when it is picked up by a user.

Since the center of mass of the remote control unit 900
20   is placed substantially near the longitudinal middle of the
remote control unit 900 (thereby having a user's thumb
naturally fall in this same center region), the standard remote
buttons 362 and menu access switches or buttons 364 most
frequently accessed and depressed by a user are placed in the
25   central region of the remote control unit 900 within easy
reach of the user's thumb. Channel and volume increment
and decrement buttons 366 are placed near this center of
mass and longitudinal center line. The channel buttons 366
are preferably beveled in opposing directions to allow a user
30   to feel for and press a desired button without looking down at
remote 900. Similarly, the volume buttons 368 are preferably
beveled in opposing directions for the same reason.

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Additionally. the channel buttons 366 could have a surface texture different from those of the volume buttons 368 to allow even easier differentiation.

5   Also placed in the longitudinal center. within easy reach of a user's thumb. are cursor movement buttons 370 and a "go" button 372. The "go" button 372 selects an option corresponding to the placement of the cursor. As opposed to buttons. a joystick may be used with a selection on the stick. or a trackball. depressible for selecting a desired

10   choice. The cursor buttons 370 are placed ninety degrees apart. with the "go" button 372 placed within the center of the cursor movement buttons 370. as shown in Figure 13b. The cursor movement buttons 370 are preferably beveled inwardly toward the "go" button 372 and the "go" button 372

15   is recessed below the level of the cursor movement buttons 370 so that it is not accidentally pressed while depressing the cursor movement buttons 370. In addition to the beveling on the cursor movement buttons 370. these buttons may also have a surface texture to allow a user to feel for and

20   select the appropriate button without looking down at the remote 900 and directional arrows could be raised or recessed on the surface of the cursor movement buttons 370 for this same purpose.

Menu select buttons 374 are placed near buttons 370 as

25   shown in Figure 13b. Menu select buttons 374 are preferably the largest buttons on the remote control unit 900. Menu select buttons 374 preferably have icons or other graphics imprinted on their top surface or adjacent to corresponding buttons. For example. a button for the sports major menu

30   may contain a baseball icon. The icons represent the programming available on the particular major menu selected by the menu select buttons 374. The icons may also be raised

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above the level of the menu select buttons to provide a textured surface. This textured surface would allow a user to select an appropriate menu button 374 by feel, without looking at the remote control unit 900. The icons would

5   require substantial differences in texture, while still providing a meaningful graphic related to the associated menu.

As shown in Figure 13b, labels and icons are provided for the following major menus: movies, sports, children's

10   programming, documentary/news, entertainment, magazines, programming guide, HDTV (high definition television), interactive TV, music, and an additional button 376 for further programming. Menu select buttons 374 may also be labeled A through J for the above programs, with the last

15   button for all additional major menus labeled K-Z.

Although the remote control unit 900 is described with a variety of channel selection buttons, nearly all buttons from a standard remote control (section 362 buttons) could be eliminated. The present invention would allow a subscriber

20   to use a remote control unit 900 containing only menu select buttons 374 and/or cursor movement and select buttons, 370, 374, respectively.

As used herein, "button" is contemplated to include all manner of switches or touch sensitive circuitry to activate a

25   particular function in the remote control unit 900. Additionally, although the remote control unit 900 communicates with the set top box by means of infrared transmission, other forms of communication are contemplated, including ultra-sound, radio frequency and

30   other electromagnetic frequency communication.

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4. Advanced Features and Functional Capabilities

a Overview

5   In the preferred embodiment, the set top terminal 220 will include features that are now being adopted in the industry, including parental controls and locks, electronic diagnostics and error detection, muting, on-screen volume control, sleep timer, recall of last selection, etc. Each of

10   these features has a corresponding menu (or overlay menu) that allows on-screen customizing and activation of the feature.

The preferred set top terminal 220 also supports a number of advanced features and functional capabilities. This

15   set top terminal 220 provides subscribers with a picture-on-picture capability without requiring a special television to support the capability. The set top terminal 220 also supports a program catalogue Service, which provides subscribers with information on all programming available at

20   its particular subscriber location. The set top terminal 220 further includes the capability of querying viewers to establish, among other things, favorite channel lists, personal profile data and mood information. The set top terminal 220 allows the subscriber to view promotional menus on future

25   programming events.

The set top terminal 220 supports additional capabilities using its hardware upgrades that allow subscribers to use other interactive services, for example, to engage in on-line question and answer sessions, to order and

30   confirm airline tickets, and to access a variety of other data services. The set top terminal 220 makes use of a digital tuner as a hardware upgrade to provide subscribers with a digital audio capability.

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The preferred set top terminal 220 may be used to control video tape machines. thereby simplifying the recording of programs. The set top terminal 220 can. in conjunction with the program delivery system. easily support

5   high definition television (HDTV). For subscribers living in remote locations. the set top terminal 220 accommodates backyard satellite systems.

In addition to all the features that the set top terminal 220 supports with its current internal programming and

10   upgradeability. additional features may be added or existing features increased through remote reprogramming of the set top terminal 220. Utilizing the resident operating system on the read only memory (ROM). the cable headend 208 is able to reprogram the random access memory (RAM) of the set

15   top terminal 220. With this capability. the cable headend 208 can remotely upgrade software on the set top terminals 220.

Reprogramming will occur by using the program control information signal. with the appropriate signals sent over this signal. In an alternative embodiment. one channel

20   is dedicated for the special programming needs. When reprogramming is to occur. the cable head end will send an interruption sequence on the program control information channel that informs the set top terminal 220 that reprogramming information is to follow.

25   b.   Picture-On-Picture Capability

Although the preferred embodiment of the present invention decompresses one channel at a time for the viewer. users who desire a picture-on-picture capability can be provided with a set top terminal 220 have upgraded hardware

30   components that allow two channels to be tuned and decompressed at any given time. Once two signals are available. the picture-on-picture capability can be made fully

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available in the set top terminal 220. without requiring a special television.

Figure 15 diagrams one embodiment for implementing the picture-on-picture capability. Such implementation
5   necessarily requires the use of two tuners 603. 603' and two decompressors 618. 618' so that two separate video programs may be displayed simultaneously on the subscriber's television screen. As shown in the figure. the CATV input signal is received by the set top terminal 220 and input into
10   two separate tuners. These tuners will each tune to a separate television program. both of which will be simultaneously displayed on the subscriber's television. The two television programs are extracted from the CATV input signal by the two parallel signals paths depicted in Figure 15.
15   Each signal path is substantially identical (therefore the components thereof are commonly numbered. with callout numbers of the components of one path carrying the prime indicator) and thus. only one path will be described. Each signal path shown includes a tuner 603. a demodulator 606. a
20   demultiplexor 609. a decryptor 600 and various decompression devices. As the respective signals pass through these devices. the microprocessor 602 coordinates the signal processing to produce a decrypted program signal. The decrypted program signal is further partitioned between
25   audio. on the one hand. and video. graphics and text. on the other. The audio signals extracted are passed to an audio decompressor 612. which further processes the audio for output to the subscriber's television.

The embodiment diagramed in Figure 15 shows only
30   single audio channels for each video channel tuned by the individual tuners. As described above. the number of audio channels will typically include four audio signals

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corresponding to a single video channel. At least two of these audio signals may be used for stereo television play. Although the subscriber can view two separate video pictures simultaneously through the picture-on-picture capability. the

5   subscriber's television can only accommodate a single audio signal at a time (or two audio signals for stereo audio reception). Thus. the set top terminal hardware shown in Figure 15 must also include a switch (not shown). which accommodates the simple switching between each audio

10   signal or signals that correspond to one video picture or another. Such an audio switch. which is a component well known in the art. allows the subscriber to listen to the audio of one picture or the other. The video. graphics and text portion of the program signal are routed through another

15   demultiplexor 314. which. in turn. separates all video. graphics and text of the signals. These signal parts are stored in a memory device 620 within the set top terminal 220. This memory device may be a ROM. RAM. EPROM. or EEPROM.

20   The microprocessor 602 initiates and coordinates further decompression of the video. graphics and text for each of the program signals. Once these signal parts are decompressed within the set top terminal 220. these components are passed to a video combiner 316. The video

25   combiner correlates and combines the video. graphics and text of the two program signals. The video combiner outputs these two signals for display on the subscriber's television. These signals may also pass through an NTSC encoder 625 to produce analog NTSC video waveforms. which may likewise

30   be displayed on the subscriber's television. Such display necessarily requires that each signal pass through an RF modulator 605 in order to be input into a television. In this

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way, two separate RF video outputs are produced. Each video signal produced by the RF modulators has its own corresponding audio outputs produced by each audio decompressor.

5   Each video signal (and its corresponding audio signal) produced by the two tuner configuration can be simultaneously displayed on the subscriber's television. which has a picture-on-picture capability, or, alternatively, the set top terminal 220 itself can create the picture-on-picture

10   image for display. Such display involves the scaling and repositioning of one of the video (and audio) signals so that both pictures produced can be viewed simultaneously. In so doing, the subscriber's television can display one of the pictures as a full screen display. with the other picture being

15   displayed as a scaled and repositioned display overlayed on the full screen display. To implement such a technique, the set top terminal 220 must include the hardware components necessary to produce a picture-on-picture capability, including hardware capable of scaling, repositioning and

20   overlaying images. Such an advanced set top terminal 220 allows the subscriber to make use of a picture-on-picture capability even though the subscriber's television cannot alone produce such a result.

          c.   Program Catalogue Service

25   Referring to Figure 15 and to Figure 8, in the preferred embodiment of the present invention, program catalogue menu 1100 listing programs available on network schedules. will be available as a major menu of the type shown as 1020. In the preferred embodiment, the major program catalogue

30   menu 1100 would offer submenus, such as network schedules for the next seven days, today's network schedules for the

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next six hours. and TV program catalogue picks for the next seven days.

In order for the set top terminal 220 to provide a program catalogue service. the set top terminal 220 must
5   receive information on all programming available at its particular subscriber location. This information will be sent to each set top terminal 220 as part of the program control information signal or STTCIS.   The program control information signal would include. among other things. all
10   programming scheduled for the next 7 days.   This programming information would. for example. include the name of each program. the type of program. the program start time. the length of the program. the date the program will be shown. a brief description of the program and
15   whether or not the program is closed-captioned. among other information.

All programming information sent to the set top terminal 220 for use with the program catalogue service will be stored in the set top terminal's internal memory. Upon
20   selection of the program catalogue service by the subscriber. the microprocessor accesses the memory device during its menu generation and creation process.   In this way. the programming information will be combined with the rogram catalogue menu or submenu template to produce the Program
25   catalogue service. The program catalogue service may involve the use of more than one menu. especially where the network scheduling information covers time frames longer than a few days.

If the particular set top terminal 220 has been
30   subscribed to the program catalogue service. the subscriber may proceed to a submenu showing schedules of programs. If the subscriber chooses the network schedule submenu 1102.

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he is offered a list of network schedules to choose from. If a subscriber were to choose, for instance, HBO, an HBO-specific submenu (not shown) would appear and allow a subscriber to choose a date of interest to see what programs
5 are available on that particular date.

d. Querying Viewer

To support a variety of services, the set top terminal 220 is capable of querying the viewer and recording viewer responses. For example, in order for the set top terminal
10 220 to establish a favorite channel list as shown at 1100 in Figure 16a depicting the broadcast TV menu 1112, menus querying the subscriber and allowing the subscriber to input his selection of eight favorite channels is displayed.

After querying the subscriber for a list of popular shows
15 the terminal displays a submenu allowing the subscriber to choose one of the subscriber's favorite or popular shows for viewing. Although various embodiments of menus are possible, the goals of each are the same -- to eliminate or augment printed guides to television programs. In an
20 alternative embodiment, a program viewing suggestion feature is available as an additional feature. This feature gives the indecisive or lazy viewer suggestions as to which programs the viewer should watch. The set top terminal 220 uses a matching algorithm to accomplish this program
25 suggestion feature. This program suggestion feature is described in detail in co-pending patent application Ser. No. PCT/US93/11708, entitled, REPROGRAMMABLE TERMINAL FOR SUGGESTING PROGRAMS OFFERED ON A TELEVISION PROGRAM DELIVERY SYSTEM.
30

In order for the set top terminal 220 to make decisions on which programs the subscriber should watch, the terminal

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must create a personal profile for the particular viewer. From the data in the particular viewer's personal profile and the television program information available in the program control information signal, the set top terminal 220 is able to

5   select a group of programs which the particular viewer is most likely to watch.

In order for this feature to operate, a personal profile for each viewer can be gathered by the set top terminal 220 and stored in a memory file. The personal profile consists of

10   demographic information that may be gathered in a number of ways. The set top terminal 220 builds the personal profile for each viewer and stores the information in a memory file by viewer name. To build a personal profile in the preferred system, the viewer answers a series of questions presented

15   on a series of menu screens. These personal profile screens request the viewer to input information such as name, sex, age, place of birth, place of lower school education, employment type, level of education, amount of television program viewing per week, and the number of shows in

20   particular categories that the viewer watches in a given week such as, sports, movies, documentaries, sitcoms, etc. Any demographic information which will assist the set top terminal 220 in targeting advertisements to the viewer or suggesting programs may be used.

25   Once a personal profile has been created (in a particular set top terminal 220), it can be indefinitely stored in nonvolatile memory. A selection at the home menu screen 1010 (Figure 8) activates the program selection feature. Following activation of the feature, the set top terminal 220

30   will present the viewer with a series of brief questions to determine the viewer's mood at that particular time, as shown in Figure 16b. For example, the first mood question

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screen 1114 may ask the viewer to select whether the viewer desires a short (30 minute), medium (30-60 minute), or long (60 plus minute) program selection. The second mood question screen 1116 requests the viewer to select between a
5 serious program, a thoughtful program, or a light program, as shown in Figure 16c. And the third mood question screen 1118 requests whether the user desires a passive program or an active program, as shown in Figure 16d. The viewer makes a selection in each question menu, utilizing the cursor
10 movement keys and "go" button on the remote control unit 900.

After the viewer has responded to the mood question menus which determine his mood, the set top terminal 220 uses the personal profile information and mood information
15 to find the best programming matches for the viewer. The set top terminal 220 displays an offering of several suggested programs to the viewer. With this program selection feature, the set top terminal 220 can intelligently assist the specific viewer in selecting a television program.

20 The personal profile information may also be used in targeting advertisements. In the preferred embodiment, the network controller 214 can target specific advertisements to individual cable distribution network nodes or, alternatively, to individual subscribers. In order to accomplish the
25 advertisement targeting capability, the network controller 214 transmits packages of advertisements to the cable distribution network nodes or subscribers for eventual display on the set top terminal 220. When the video that the subscriber is watching nears a break for a commercial, a
30 specific advertisement or set of advertisements is specifically targeted to a particular set top terminal 220 based on the personal profile information described above. Although the

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network controller 214 is the component in the program
delivery system which provides this targeting capability. the
set top terminal 220 accommodates transparent channel
switches to display the targeted advertisement. In this way.
5 although the subscriber thinks that the set top terminal 220
is tuned to a specific channel. an advertisement from another
channel is displayed on the subscriber's television.

The hardware required to accommodate such
transparent channel switching capabilities are shown in
10 Figures 17a and 17b. Figure 17a shows the set top terminal
hardware components which accommodate channel
switching within a single 6 MHz channel bandwidth. These
components include a tuner 603. a demodulator 606. a
demultiplexer 609. a multiplexer 400. a decompressor 622. a
15 microprocessor 602. and local memory M. The tuner 603
operates by tuning to a specific 6 MHz bandwidth which
includes the displayed video and a number of channels
carrying advertisements. The demodulator 606 processes
these signals and sends them to the demultiplexor 609.
20 which converts the received signal into separate program and
advertisement signals.   During this processing. the
microprocessor 602 coordinates the demultiplexing of the
programming signals. Once the video signal pauses for a
commercial break. the microprocessor 602 instructs the
25 multiplexer 400 to select the advertisement or
advertisements for decompression and subsequent display on
the subscriber's television. This hardware configuration
allows the set top terminal 220 to switch between channels
within the 6 MHz bandwidth and display various
30 advertisements for viewing. regardless of the video currently
being watched by the subscriber.

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Where a targeted advertisement falls outside the tuned 6 MHz bandwidth containing the video that the subscriber is currently watching, the hardware configuration shown in Figure 17b is used. In this configuration, the microprocessor

5   602 instructs the tuner 603 to retune to another 6 MHz channel bandwidth, as represented by bi-directional arrow A.

Working together, the microprocessor 602 and tuner 603 allow targeted advertisements, which have been transmitted in another 6 MHz bandwidth, to be tuned with

10   minimal acquisition time and delay. In particular, this configuration allows the set top terminal 220 to tune outside a given 6 MHz bandwidth (to another 6 MHz bandwidth) in order to select a targeted advertisement for display. This alternative embodiment may require the use of a full screen

15   mask in order to minimize any annoying screen rolling during the tuning process. The masking is intended to cover any glitches which would otherwise be displayed during the acquisition time (e.g., 0.5 seconds) for retuning to another 6 MHz channel bandwidth.

20   Where the acquisition time or delay becomes unreasonable, an alternative embodiment (not depicted) can include the use of two tuners similar to the configuration used above for the picture-on-picture capability. This alternative configuration using two tuners trades an increased

25   cost for lower acquisition times. Those skilled in the art will recognize a number of other configurations of set top terminal hardware that will accommodate a transparent channel switching feature. A more detailed description of target advertising and channel switching is provided in

30   patent application Ser. No. PCT/US93/11616, entitled, NETWORK CONTROLLER FOR CABLE TELEVISION DELIVERY SYSTEM.

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e.   Promotional Menus

Figure 18 depicts the use of a promotional menu 1120
used to sell subscriptions to services in the system 200. This
promotional menu is tailored to Level B interactive services
5   which include a variety of on-line type services such as
Prodigy, Yellow Pages, Airline Reservations, etc. A similar
menu is used for Level A interactive services that offers
subscribers additional information about programs such as
quizzes, geographical facts, etc. Such information may be
10   received by the set top terminal 220 in several data formats,
including in the vertical blanking interval (VBI) and in the
program control information signal.

Other promotion menus similar to menu 1120 may be
used for the Level C interactive services. The Level C
15   interactive services utilize local storage such as CD technology
(e.g., 122) to offer an enormous range of multi-media
experiences. The Level C interactive services require a
hardware upgrade as described earlier. Specially adopted CD-
I and CD-ROM 122 units are used for this service.

20   Typically, promotional menus may be generated when a
subscriber selects a nonexistent channel, creating a virtual
channel. Such virtual channels do not require any additional
bandwidth since these channels do not carry any of the data
required to create a promotional menu. Instead, when the
25   subscriber selects a channel that does not exist (e.g., Channel
166), a virtual channel is created using data sent to the set
top terminal in a number of ways. For example, the data may
be sent in the vertical blanking interval (VBI) of another
channel, out-of-band, or with the menu information sent from
30   the headend 208 in the set top terminal control information
stream (STTCIS). The data will be used to create graphics
stored locally at the set top terminal 220 as an NTSC video

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signal which may be displayed on the subscriber's television. In this way, a promotional menu may be drawn and a virtual channel is created. This capability simply provides the set top terminal 220 with the ability to display a promotional menu 5 or graphics display whenever a nonexistent channel is selected by the subscriber.

f.   Other Interactive Services

Figures 19a and 19b show menus (1130 and 1132, respectively) that are available using the interactive Level A 10 services. Referring to Figure 19a, when interactive Levels A services are available for a television program, the system will display an interactive logo 1134 consisting of the letter "I" and two arrows with semicircular tails. In the preferred embodiment, the set top terminal 220 will place the 15 interactive logo on the television screen as an overlay menu. In the preferred embodiment, the set top terminal 220 will detect that there is data or information available about a television program which can be displayed to a subscriber using the interactive service. When the set top terminal 220 20 senses that there is interactive information available, it will generate the interactive logo overlay menu 1134 and place it on the television screen. For example, the set top terminal 220 will detect that information on a television program is being sent in the vertical blanking interval (VBI) and generate 25 an interactive logo overlay menu 1134 which will appear on the subscriber's television screen for approximately fifteen seconds during each ten minute interval of programming. Similarly, the set top terminal 220 can sense that the programming has closed caption information available and 30 place a closed caption logo on the screen.

Referring to Figure 19b, when the subscriber sees the interactive logo 1134 on the television screen, the subscriber

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is made aware of the fact that interactive services are available
in conjunction with his television program. If the subscriber
presses the interactive remote control button, another
overlay menu 1133 will be generated by the set top terminal

5 220 and placed on the screen. This overlay menu 1133 is
shown in Figure 19b being overlayed on an interactive
television program. From this menu 1133, the subscriber
may select a variety of different types of textual interactivity
with the current television program, as at 1134, including

10 quizzes, fast facts, more info, where in the world, products,
etc. At any time during the interactive submenus, the user
may return to the television program without interactive
features.

Another submenu 1136 gives additional information

15 related to the television program to the viewer in textual
form in the lower half of the screen. In Figure 19b, the
submenu 1136 shows the available interactive options for the
subcategory "quiz." In this interactive subcategory, the user
is presented with questions and a series of possible answers.

20 If the subscriber desires, the subscriber selects one of the
answers to the quiz question. After the selection, the set top
terminal 220 sequences to another menu. The set top
terminal 220 sequences to the interactive quiz answers
submenu which informs the subscriber whether the correct

25 answer was or was not chosen. Subsequently, another
submenu would show correctly or incorrectly answered quiz
question.

Figure 20a is an example of a submenu for Level B
interactive services. From this menu screen 1141, any of a

30 number of on-line data services could be accessed. One
service, the airline reservations selection 1142, has been
chosen by the subscriber on this menu.

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In selecting airline reservations. the subscriber encounters a sequence of menus as for any on-line data service. Referring to Figure 20b. the subscriber is typically shown a submenu. such as submenu 1144. for the data service

5 offering various options. In each of these submenus related to a data service. the subscriber is able to exit. returning to the home menu 1010 or regular cable TV.

Figure 20b. the airline information and reservation submenu 1144. allows a subscriber to view six available

10 flights. A subscriber may select one of the flights to check on its availability. Another similar submenu allows a subscriber to enter the month. day and year for the availability date desired. In this submenu. the subscriber is offered the option of correcting any errors in the entered information.

15 Figure 20c is another airline submenu 1150 that allows a subscriber to view remaining seats available on a flight. enabling the selection of a seat assignment. This interactive submenu 1150 is an example of how information may be graphically shown to a subscriber using a portion of the menu

20 and different coloring schemes. In this interactive menu. the lower half of the screen 1152 shows the passenger compartment of an airplane with all the seat locations graphically represented by square blocks. By coloring the available seat locations in blue and the unavailable seat

25 locations in a different color. the menu can present a great deal of information in a limited amount of space. This graphic presentation of information for the interactive on-line data services is an important method of visually displaying large amounts of information to the subscriber.

30 Referring to Figure 20d. another submenu 1156 allows the subscriber to choose a one-way or round-trip ticket. to confirm reservations and to charge an airline ticket by credit

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card, choosing the appropriate strip menu on the lower part
of the screen. In this particular menu 1156, the subscriber is
charging a round-trip plane ticket on a credit card. The
subscriber simply needs to enter the credit card number,
5   expiration date, and credit card type to charge an airline
ticket. Other submenus may process the subscriber's credit
card charge for the airline ticket, confirm the subscriber's
airline ticket purchase, and pass this information to the
location where the ticket is printed.

10   Using the methods and hardware described, a variety of
interactive services are possible. Those skilled in the art will
recognize that such interactive services may be
accommodated by the preferred set top terminal 220.

           g.   Caller ID

15   Using the capability of the set top terminal and a
connected modem, the set top terminal is able to perform
the function of caller ID. The caller ID function of the set top
terminal assists the viewer in a manner similar to the caller
ID function provided by telephone companies. However, the
20   set top terminal is able to use the television as its display
means to communicate to the viewer information about
incoming telephone calls. Also, the strong local processing
capability of the set top terminal allows the caller ID function
to be much more user friendly and convenient.

25   If the set top terminal senses that a viewer is using the
system and watching television, then the caller ID feature
would automatically be activated. When the caller ID function
is active, the set top terminal software will monitor incoming
telephone calls to the viewer through the modem. After the
30   set top terminal senses that the phone is ringing, signals are
received on the tip and ring lines of the telephone, the
system will immediately look for incoming telephone data

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identifying the telephone number from which the telephone call was initiated.

Upon receiving the telephone number from which the call was initiated, the preferred embodiment of the caller ID

5   compares the telephone number with a list of telephone numbers stored in memory. The list of telephone numbers stored in memory is cross referenced to a list of names, other textual data or graphics. When the set top terminal finds a match between the telephone number and a number stored

10   in memory, the corresponding text or graphics are displayed on the television screen. For example, "GRANDMA" and a "smiley face" graphic can be flashed across the television screen using an overlay menu.

In this manner the viewer may see the name (and

15   identifying icon graphics) of the person placing the call and can decide whether to activate an automatic telephone message recording system or answer the telephone call. After generating an overlay menu, the set top terminal software awaits an IR command signifying a viewer response.

20   With the simple depression of a button on the remote control, the viewer can instruct the set top terminal to send an activation signal to the automatic telephone message system (through a set top terminal port). Thus, the viewer can continue to watch a program and know the identity of a

25   caller without taking his or her eyes off the television. If a dumb telephone message system is used, the viewer can simply allow the telephone to ring the requisite number of rings until the telephone answering machine normally activates and answers the call.

30   In an alternative embodiment, having no stored telephone numbers, the set top terminal may just flash the incoming telephone number on the screen using an overlay

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menu. In a more sophisticated embodiment, a microphone is provided in the set top terminal or remote control unit. Using the television's speakers, a remote control, and a microphone, the viewer is able to answer the telephone using the keys of the remote control without taking his or her eyes off the television screen.

h. Digital Audio Capability

Referring to Figure 21, the digital audio feature of the invention allows a subscriber to listen to CD quality audio selections through the subscriber's stereo (not shown). This can be accomplished by running cables directly from the set top terminal 220 (which may include a Level D hardware upgrade) to the subscriber's amplifier/stereo system. Alternatively, the subscriber may listen to audio selections through the subscriber's television system.

In the preferred embodiment, the digital audio feature uses a Level D hardware upgrade as a digital radio tuner. This Level D hardware upgrade enables a subscriber to use the program delivery system's digital audio signaling capability. Digital audio transmissions require much less bandwidth than that used for the transmission of a digital video signals. Thus, hundreds of digital audio programs are delivered to each set top terminal 220 in limited segments of bandwidth.

Where digital audio programs are delivered to the set top terminal 220, the Level D upgrade (shown in Figure 13b) provides the subscriber with the means to select a given digital audio program for listening. The Level D hardware upgrade makes use of a tuner 603 that is separate from the tuner 603 used by the set top terminal 220 for video display. The digital audio signal is received at the set top terminal 220 over the CATV transmission media. The set top terminal 220, in turn, routes the digital audio signal to the

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components of the Level D hardware upgrade. These
components may include: a tuner 603, demodulator 606,
demultiplexer 609, decryptor, decompressor 622, remote
control interface and microprocessor 602.

5   The Level D hardware upgrade will use its tuner 603 to
tune to the specific digital audio program selected by the
subscriber and subsequently demodulate, demultiplex and
decrypt the digital audio signal. Upon completion of this
processing, the digital audio signal will be decompressed to
10   produce a processed digital audio signal ready to be output to
the subscriber's stereo or directly to speakers.

The Level D hardware upgrade includes ports for the
digital audio signal output, which provide the necessary
connections for transmission of the signal from the Level D
15   hardware upgrade to the subscriber's stereo. In addition, the
Level D hardware upgrade include a small LED display that
can show the channel number of the program selected, date
and time, among other display fields.

The Level D hardware upgrade can be physically located
20   in a different room from that of the television and set top
terminal 220. Thus, the Level D hardware upgrade will have
its own remote control device (not shown), albeit with less
available options and keys than the set top terminal's remote
control 900 described above. This Level D hardware upgrade
25   remote control is more limited than the set top terminal's
remote control 900 since the Level D remote control will be
used exclusively for digital audio program selection. This
limited remote control, nevertheless, includes a small LED or
LCD display that is used to display the channel number of the
30   digital audio program selected. Alternatively, the set top
terminal's remote control may be programmed for use with

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the Level D hardware upgrade so that an additional remote
control is not required to use the digital audio feature.

Using either remote control embodiment, the
subscriber accesses the Level D hardware upgrade to select a

5   digital audio program. The remote control sends an IR
command signal to the Level D hardware upgrade, instructing
the unit's microprocessor 602 to initiate the selection of a
given program. The desired program is processed (i.e.,
tuned, demultiplexed, decrypted and decompressed) as

10   described above and transmitted to the subscriber's stereo
for listening.

The selection of a digital audio program does not
necessarily require interaction with the subscriber's
television. Instead, all communications required to select a

15   digital audio program may occur between a remote control
and the Level D hardware upgrade. As a result, the
subscriber's television need not be turned on for the digital
audio capability to operate.

Alternatively, the Level D hardware upgrade can be co-

20   located with the set top terminal 220 and the subscriber can
select a digital audio program through a menu displayed on
the subscriber's television. In this embodiment, the
subscriber would use the set top terminal remote control to
access a digital audio program selection menu.

25   In an alternative embodiment, the set top terminal 220
includes all the features of the Level D upgrade and,
therefore, no upgrade is necessary. Those skilled in the art
will recognize other alternatives that allow digital audio
reception.

30   Figure 21 is a major menu 1160 displaying the digital
audio program choices which are available for subscribers
who have paid the monthly fee. In a chart format 1162, the

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major menu shows the top five. ten. and forty songs available in six different categories of music. Below the chart. the system is able to provide a text message 1164 describing the particulars of the audio program selected. Using the same

5   logos and menu format. the system can provide a text description enticing the subscriber to pay the monthly fee and join the service. For example. one menu may allow the user to test the system with a free demonstration. Another menu allows the subscriber to request additional promotional

10   information about the system. Such menus may be used throughout the menu system. From any of the menu screens for the digital audio feature. the subscriber may return to regular cable TV with the press of a single button.

                          L.   VCR Control

15   Referring to Figure 22. the advanced system of the set top terminal 220 is used to control video tape machines and simplify recording programs using a Guide Record feature. The set top terminal 220 has a separate output 650 for a VCR. Control signals are transmitted through the VCR output of the

20   set top terminal 220 and input to the VCR to allow the VCR to be automatically controlled by the set top terminal 220. Using the set top terminal 220. certain programs are selected by a subscriber from menus. and the VCR will be automatically activated to record the selected program.

25   In order to accommodate the VCR control feature. the set top terminal 220 sends instructions or control signals to the VCR. Such control signals are initiated by the set top terminal's microprocessor 602 and passed to the VCR either using a separate connection or as part of the video signals

30   processed for display on the subscriber's television. These control signals are sent directly from the advanced set top

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library order by pressing the escape button. This menu
shows that the subscriber has chosen to return to regular TV.
The subscriber's VCR or other video taping equipment must
be connected to the set top terminal 220 for the automatic

5   taping feature to operate.

Following a program choice. a program description
submenu is placed on the television screen. In addition. from
this program description submenu. the viewer may choose to
record the selected program on his VCR using the guide

10   record feature. If the guide record feature is chosen. the
guide record submenu 1170 shown in Figure 22 provides the
subscriber with further instructions. In order for the set top
terminal 220 to perform the guide record functions and
operate the VCR, control signals are sent from the set top

15   terminal 220 to the VCR via the video connection 650 or
through a separate connection between the set top terminal
220 and the VCR. The VCR is capable of interpreting these
control signals from the set top terminal 220 and performing
the desired function (such as. activating the record feature).

20   In the preferred embodiment. the VCR control signals are
sent with the video signal and output from the output 650. as
described above. Alternatively. a separate connection
between the set top terminal 220 and VCR may be used.

            J.   HDTV Capability

25   The set top terminal 220 and program delivery system
of the preferred embodiment can easily support high
definition television (HDTV). The combination of digital
video. compression and no restricted bandwidth limitation
per channel makes the preferred system ideal for HDTV.

30   The greater information flow of HDTV causes no problems for
the system. The menu selection system of the preferred

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terminal 220 to the VCR, instructing the VCR when to begin and end taping of a particular program.

The microprocessor 602 coordinates the dissemination of control signals sent to the VCR, storing the content of such

5   signals in local memory. Upon nearing the time for the program to be displayed, the microprocessor 602 activates the menu generation software to display a notification menu or screen, notifying the subscriber that the program is nearing the time for display. This reminder will also request

10   the subscriber to check whether a tape has been inserted into the VCR itself.

The subscriber can initiate the VCR control feature by accessing a VCR control submenu, which requests whether the subscriber wishes to record a program selected for future

15   viewing. In this way the subscriber interactively enters such information on the menu screen or display using any of the hardware described above that accommodates subscriber interactive response capabilities.

In the preferred embodiment, the subscriber will use a

20   movie library in conjunction with his VCR or other video taping machinery. The movie library is a menu selectable list of available movies. In that way, a subscriber may tape movies which are shown at inconvenient start times for later viewing. By enabling the proper features of the set top terminal 220, a

25   subscriber can have the terminal activate the television and the VCR and perform all the functions necessary to tape a movie.

After the VCR control feature is initiated, a menu screen confirms the movie selection, start date and start time

30   and informs the subscriber that the VCR will be automatically turned on. During this submenu, the user may return to the movie library major menu, or regular TV or cancel the movie

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embodiment is a user friendly manner of presenting HDTV
programming to the subscriber.

Figure 23 shows the integration of HDTV services into
the menu-driven program delivery system. If the subscriber
5   selects the major menu for HDTV 1032, the subscriber will
receive either a description of the service with a suggestion
to order the system, or a text note that the subscription is
current and a listing of the currently available program
selections in HDTV. If the subscriber has not paid to join the
10   particular service, HDTV, the subscriber may be allowed to
join one of the programs in progress for a limited time as a
demo to entice the subscriber to order.

If a subscriber has paid the HDTV fees, the subscriber
proceeds as in any other major menu screen. This particular
15   major menu shows an example of how a follow-on or second
screen may exist for the same menu. In this particular case, a
second screen exists for the major menu HDTV 1032. The
subscriber may access the second screen by selecting the last
menu display block 1172 "Other HDTV Selections" in the
20   lower part of the screen. Following this selection, the
subscriber will be given a second screen of program
selections. In this manner, any menu can have multiple
screens with many program choices. This type of screen
pagination on one menu allows the operations center 202
25   packager to avoid categorizing program selections within that
same menu. In an alternative embodiment, the options
available to the subscriber may be scrolled on one menu
screen with the text within the menu display blocks changing
as the subscriber scrolls up or scrolls down. Many variations
30   of this HDTV example can be used with the described system.

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k.   Backyard System

In an alternative configuration. In areas without cable services where subscribers use backyard satellite systems (TV RO) to receive packaged television services. the set top
5   terminal 220 will include the appropriate hardware to allow connection to the satellite 206 reception equipment through port 656. In this configuration. the menu system within the set top terminal 220 will be programmed directly from the operations center 202.   Additionally. an upstream
10   communication mechanism must be in place at the subscriber's home (i.e. modem) to communicate information to the operations center.

The hardware components that allow the set top terminal 220 to operate in a backyard system typically will
15   not be included within the set top terminal shell itself. Instead. any such components accommodating the set top terminal's interoperability with a backyard program delivery system will typically reside outside the subscriber's home. As a result. the set top terminal 220 will operate as described
20   above. notwithstanding any change in program delivery transmission media.

The terms and descriptions used herein are set forth by way of illustration only and are not meant as limitations. Those skilled in the art will recognize that numerous
25   variations are possible within the spirit and scope of the invention as defined in the following claims.

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CLAIMS

What is claimed is:

1.   A hardware upgrade for a terminal, the hardware upgrade comprising:

an interface to the terminal whereby subscriber selections and audio signals that represent audio programs may be received;

audio processing circuitry, connected to the interface, that processes the audio signals; and

an output, connected to the processing circuitry, that outputs a selected audio signal based on the subscriber selections.

2.   The hardware upgrade of claim 1, wherein the audio processing circuitry comprises a tuner.

3.   The hardware upgrade of claims 1 or 2, wherein the audio signals are digital audio signals and the audio processing circuitry comprises a demodulator.

4.   The hardware upgrade of claim 1, 2 or 3, wherein the audio signals are digital audio signals and the audio processing circuitry comprises digital audio processing circuitry.

5.   The hardware upgrade of claim 4, wherein the digital audio processing circuitry comprises a demultiplexor to select the selected audio signal.

6.   The hardware upgrade of any of claims 4 or 5, wherein the digital audio signals are encrypted and the digital audio processing circuitry comprises a decryptor.

7.   The hardware upgrade of any of claims 4-6, wherein the digital audio signals are compressed and the digital audio processing circuitry comprises a decompressor.

8.   The hardware upgrade of any of claims 1-7, wherein the output is one or more connectors to one or more speakers.

9.   The hardware upgrade of any of the claims 1-7, wherein the output is one or more connectors to a stereo.

10.   The hardware upgrade of any of claims 1-9, further comprising a microprocessor connected to the interface and processing circuitry, the microprocessor accepting the subscriber selections and controlling the audio processing circuitry.

11.   The hardware upgrade of any of claims 1-10, further comprising a remote

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control unit, the remote control unit comprising inputs for entering the subscriber selections.

12. The hardware upgrade of claim 11 wherein the remote control unit comprises a display.

13. The hardware upgrade of claim 12 wherein the display comprises a channel identifier display that displays a channel identifier corresponding to a subscriber selection.

14. The hardware upgrade of claim 12 wherein the display comprises an LED device.

15. The hardware upgrade of claim 12 wherein the display comprises an LCD device.

16. The hardware upgrade of any of claims 1-15, wherein the interface to the terminal comprises a four-wire connector.

17. The hardware upgrade of any of claims 1-16, wherein the interface to the terminal comprises a multipin connector.

18. The hardware upgrade of claim 17 wherein the multipin connector is a multipin connector ranging from type DB9 to type DB25.

19. The hardware upgrade of any of claims 1-18, wherein the interface to the terminal comprises a SCSI connector.

20. The hardware upgrade of any of claims 1-19, further comprising a menu generator, whereby the subscriber selections comprise menu selections from one or more menus generated by the menu generator.

21. The hardware upgrade of any of claims 1-20, further comprising a channel identifier display that displays a channel identifier corresponding to a subscriber selection.

22. The hardware upgrade of any of claims 1-21, wherein the selected audio signals is a stereo signal comprising left and right components.

23. A system for delivery and reception of audio programs, the system comprising:

a television program delivery system adapted to deliver programs including audio programs; and

a terminal adapted to receive the programs from the television program delivery system, the terminal comprising:

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a receiver adapted to receive the programs including the audio programs;

a subscriber interface adapted to receive subscriber inputs including subscriber audio program selections; and

a hardware upgrade, connected to receive the subscriber selections and audio signals that represent the audio programs, the hardware upgrade comprising:

an interface to the terminal whereby the audio signals and subscriber selections may be received;

audio processing circuitry, connected to the interface, that processes the audio signals; and

an output, connected to the processing circuitry, that outputs a selected audio signal based on the subscriber selections.

24.   The system of claim 23 wherein the television program delivery system is a cable television program delivery system.

25.   The system of claims 23 or 24, wherein the cable television program delivery system further comprises an operations center, the operations center transmitting one or more of the programs to the terminal.

26.   The system of any of claims 23-25, wherein the cable television program delivery system further comprises one or more headends , a particular one of the one or more headends transmitting one or more of the programs to the terminal.

27.   The system of any of claims 23-26, wherein the television program delivery system is a direct satellite broadcast system.

28.   The system of any of claims 23-27, wherein the television program delivery system comprises one or more fiber optic connections to the terminal.

29.   The system of any of claims 23-28, wherein the television program delivery system comprises one or more telephone line connections to the terminal.

30.   The system of any of claims 23-29, wherein the terminal is a set top terminal.

31.   A method for receiving audio programs at a terminal capable of receiving audio/visual programs in addition to the audio programs, an audio/visual program being represented by an audio signal accompanied by a corresponding video signal, and an audio program being represented an audio signal only, the method

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comprising the steps of:

receiving digital audio signals that represent the audio programs;

receiving subscriber selections;

selecting one of the digital audio signals using one or more of the
subscriber selections;

processing the selected audio signal; and

outputting the processed audio signal.

32. The method of claim 31 wherein the step of processing comprises tuning.

33. The method of claims 31 or 32, wherein the step of processing comprises
demodulating.

34. The method of any of claims 31-33, wherein the step of processing comprises
demultiplexing to select the selected audio signal.

35. The method of any of claims 31-34, wherein the digital audio signals are
encrypted and the step of processing comprises decrypting.

36. The method of any of claims 31-35, wherein the digital audio signals are
compressed and the step of processing comprises decompressing.

37. The method of any of claims 31-36, further comprising the step of:

playing the selected audio program on one or more speakers.

38. The method of any of claims 31-37, further comprising the step of:

playing the selected audio program on a stereo.

39. The method of any of claims 31-38, wherein the terminal comprises a
microprocessor, the method further comprising the step of:

controlling the processing and selecting steps using the
microprocessor.

40. The method of any of claims 31-39, further comprising the step of:

entering the subscriber selections on a remote control unit.

41. The method of any of claims 31-40, further comprising the step of:

displaying a channel identifier corresponding to a subscriber selection.

42. The method of claim 41 wherein the display comprises an LED device.

43. The method of claim 41 wherein the display comprises an LCD device.

44. The method of any of claims 41-43, further comprising the steps of:

generating one or more menus; and

receiving one or more of the subscriber selections from one or more

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menus generated by the menu generation capability.

45. The method of any of claims 41-44, further comprising the step of:

receiving a data signal that identifies the audio programs.

46. The method of any of claims 41-45, wherein the selected audio signal is a stereo signal comprising left and right components.

47. The method of any of claims 41-46, wherein the terminal is a set top terminal.

48. An apparatus capable of receiving audio/visual programs and audio programs, an audio/visual program being represented by an audio signal accompanied by a corresponding video signal, and an audio program being represented an audio signal only, the apparatus comprising:

a receiver adapted to receive the programs including audio programs represented by digital audio signals;

a subscriber interface adapted to receive subscriber inputs including subscriber audio program selections;

audio processing circuitry, connected to the receiver, that processes the audio signals; and

an output, connected to the processing circuitry, that outputs a selected audio signal based on the subscriber selections.

49. The apparatus of claim 48 wherein the audio processing circuitry comprises a tuner.

50. The apparatus of claims 48 or 49, wherein the audio processing circuitry comprises a demodulator.

51. The apparatus of any of claims 48-50, wherein the audio processing circuitry comprises a demultiplexor to select the selected audio signal.

52. The apparatus of any of claims 48-51, wherein the digital audio signals are encrypted and the audio processing circuitry comprises a decryptor.

53. The apparatus of any of claims 48-52, wherein the digital audio signals are compressed and the audio processing circuitry comprises a decompressor.

54. The apparatus of any of claims 48-53, wherein the output is one or more connectors to one or more speakers.

55. The apparatus of any of claims 48-54, wherein the output is one or more connectors to a stereo.

56. The apparatus of any of claims 48-55, further comprising a microprocessor

connected to the subscriber interface and processing circuitry.

57. The apparatus of any of claims 48-56, further comprising a remote control unit, the remote control unit comprising inputs for entering the subscriber selections.

58. The apparatus of claim 57 wherein the remote control unit comprises a display.

59. The apparatus of claim 58 wherein the display comprises a channel identifier display that displays a channel identifier corresponding to a subscriber selection.

60. The apparatus of claim 58 wherein the display comprises an LED device.

61. The apparatus of claim 58 wherein the display comprises an LCD device.

62. The apparatus of any of claims 48-61, further comprising a menu generator, whereby the subscriber selections comprise menu selections from one or more menus generated by the menu generator.

63. The apparatus of any of claims 48-62, wherein the receiver is further adapted to receive one or more data signals that contain information about the audio programs.

64. The apparatus of any of claims 48-63, wherein the selected audio signal is a stereo signal comprising left and right components.

65. The apparatus of any of claims 48-64, wherein the apparatus is a set top terminal.

66. The apparatus of any of claims 48-65, further comprising a display.

67. The apparatus of any of claims 48-66, wherein the display comprises a channel identifier display that displays a channel identifier corresponding to a subscriber selection.

68. The apparatus of any of claims 48-67, wherein the display comprises an LED device.

69. The apparatus of any of claims 48-68, wherein the display comprises an LCD device.

70. A hardware upgrade for a terminal for use with a television program delivery system, the hardware upgrade comprising:

> an interface to the terminal, whereby interactive subscriber input is transferred from the terminal for processing and interactive output is transferred to the terminal for display;

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a memory storing interactive software; and

a microprocessor, connected to the interface and memory, that processes the interactive subscriber input and produces the interactive output in accordance with the interactive software.

5   71.   The hardware upgrade of claim 70, further comprising processing circuitry, connected to the microprocessor, whereby the processing circuitry interprets the interactive subscriber input.

72.   The hardware upgrade of claims 70 or 71, further comprising a bubble memory connected to the microprocessor, the bubble memory temporarily storing

10   the interactive subscriber input and interactive output.

73.   The hardware upgrade of any of claims 70-72, further comprising a long-term memory connected to the microprocessor, the long-term memory storing interactive data.

74.   The hardware upgrade of any of claims 70-73, wherein the interactive

15   subscriber input and interactive output are text.

75.   The hardware upgrade of any of claims 70-74, wherein the interactive subscriber input comprises answers and the interactive output comprises questions.

76.   The hardware upgrade of any of claims 70-75, wherein the interface to the terminal additionally transfers, to the hardware upgrade, information concerning

20   programs, and the interactive software comprises programming instructions for processing the information concerning programs.

77.   The hardware upgrade of any of claims 70-76, wherein the information concerning programs is selected from a group consisting of quizzes, facts, geographical information, and product information.

25   78.   The hardware upgrade of any of claims 70-76, further comprising a modem, connected to the microprocessor, that communicates with at least one interactive service.

79.   The hardware upgrade of claim 78, wherein the interactive service is outside of the television program delivery system.

30   80.   The hardware upgrade of claims 78 or 79, wherein the interactive service is selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

81. The hardware upgrade of any of claims 70-77, further comprising a modem, connected to the microprocessor, that communicates with at least one on-line database.

82. The hardware upgrade of claim 81, wherein the on-line database is outside of the television program delivery system.

83. The hardware upgrade of claims 81 or 82, wherein the on-line database contains data concerning one or more applications selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

84. The hardware upgrade of any of claims 70-83, further comprising a storage device (122) connected to the microprocessor, the storage device capable of storing digital data.

85. The hardware upgrade of claim 84, wherein the storage device is a CD-ROM.

86. The hardware upgrade of claims 84 or 85, wherein the interactive software comprises programming instructions for processing the digital data stored on the storage device.

87. The hardware upgrade of any of claims 84-86, wherein the stored digital data concerns one or more applications selected from a group consisting of games, education, encyclopedias, reference, and economics.

88. The hardware upgrade of any of claims 84-87, wherein the interface to the terminal additionally transfers, to the hardware upgrade, information concerning programs, and the interactive software comprises:

    programming instructions for monitoring the information concerning programs; and

    programming instructions for triggering retrieval of the stored digital data.

89. The hardware upgrade of any of claims 70-88, wherein the interface to the terminal comprises a four-wire connector.

90. The hardware upgrade of any of claims 70-89, wherein the interface to the terminal comprises a multipin connector.

91. The hardware upgrade of claims 90, wherein the multipin connector is a multipin connector ranging from type DB9 to type DB25.

92. The hardware upgrade of any of claims 70-91, wherein the interface to the

terminal comprises a SCSI connector.

93. The hardware upgrade of any of claims 70-92, further comprising a remote control unit, the remote control unit comprising inputs for entering the interactive subscriber input.

94. The hardware upgrade of any of claims 70-93, further comprising a menu generator, wherein the interactive subscriber input comprises menu selections from one or more menus generated on a television by the menu generator.

95. An interactive television system comprising:

a television program delivery system adapted to deliver television program signals; and

a terminal comprising:

a receiver adapted to receive the television program signals;

a subscriber interface adapted to receive interactive subscriber input; and

a hardware upgrade, connected to receive the interactive subscriber input, the hardware upgrade comprising:

an interface to the terminal , whereby the interactive subscriber input is transferred from the terminal for processing and interactive output is transferred to the terminal for display;

a memory storing interactive software; and

a microprocessor, connected to the interface and memory, that processes the interactive subscriber input and produces the interactive output in accordance with the interactive software.

96. The system of claim 95, wherein the television program delivery system is a cable television program delivery system.

97. The system of claims 95 or 96, wherein the television program delivery system further comprises an operations center, the operations center transmitting one or more of the programs to the terminal.

98. The system of any of claims 95-97, wherein the cable television program delivery system further comprises one or more headends, a particular one of the one or more headends (208) transmitting one or more of the programs to the terminal.

99. The system of any of claims 95-98, wherein the television program delivery

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system is a direct satellite broadcast system.

100. The system of any of claims 95-99, wherein the television program delivery system comprises one or more fiber optic connections to the terminal.

101. The system of any of claims 95-100, wherein the television program delivery system comprises one or more telephone line connections to the terminal.

102. A method for interacting with a subscriber using a television program delivery system, the method comprising the steps of:

        receiving a television program;

        receiving interactive subscriber input;

        storing interactive software;

        processing the interactive subscriber input in accordance with the interactive software;

        producing interactive output in accordance with the interactive software; and

        displaying the television program and interactive output on a video display.

103. The method of claim 102 further comprising the step of:

        interpreting the interactive subscriber input.

104. The method of any of claims 102-103, wherein the interactive subscriber input and interactive output are text.

105. The method of any of claims 102-104, further comprising the steps of:

        posing questions in the interactive output; and

        receiving, as part of the interactive subscriber input, answers to the questions posed in the interactive output.

106. The method of any of claims 102-105, further comprising the steps of:

        receiving information concerning programs; and

        processing the information concerning programs.

107. The method of claim 106, wherein the information concerning programs is received in a vertical blanking interval.

108. The method of claim 106, wherein the information concerning programs is received in a program control information signal.

109. The method of any of claims 106-108, wherein the information concerning programs is selected from a group consisting of quizzes, facts, geographical

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information, and product information.

110. The method of any of claims 102-109, further comprising the step of:

    communicating with at least one interactive service.

111. The method of claim 110, wherein the interactive service is outside of the television program delivery system.

112. The method of any of claims 110 or 111, wherein the interactive service is selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

113. The method of any of claims 102-112, further comprising the step of:

    communicating with at least one on-line database.

114. The method of claim 113, wherein the on-line database is outside of the television program delivery system.

115. The method of claims 113 or 114, wherein the on-line database contains data related to one or more applications selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

116. The method of any of claims 102-115, further comprising the step of:

    storing digital data on a storage device.

117. The method of claim 116, wherein the storage device is a CD-ROM.

118. The method of claims 116 or 117, further comprising the step of:

    processing the digital data stored on the storage device.

119. The method of any of claims 116-118, wherein the stored digital data concerns one or more applications selected from a group consisting of games, education, encyclopedias, reference, and economics.

120. The method of any of claims 116-119, further comprising the steps of:

    receiving information concerning programs;

    monitoring the information concerning programs;

    triggering retrieval of the stored digital data; and

    retrieving the stored digital data.

121. The method of claim 120, wherein the information concerning programs is received in a vertical blanking interval.

122. The method of claim 120, wherein the information concerning programs is

received in a program control information signal.

123. The method of any of claims 102-122, further comprising the step of:

remotely receiving the interactive subscriber input.

124. The method of any of claims 102-123, further comprising the steps of:

generating an overlay menu on a television;

receiving menu selections from one or more overlay menus, whereby the menu selections comprise the interactive subscriber input.

125. The method of any of claims 102-124, wherein the terminal is a set top terminal.

126. An apparatus for use with a television program delivery system, the apparatus comprising:

a receiver capable of receiving a television program;

a subscriber interface adapted to receive interactive subscriber input;

a memory storing interactive software; and

a microprocessor, connected to the subscriber interface and memory, that processes the interactive subscriber input and produces interactive output in accordance with the interactive software; and

a display that displays the television program and interactive output.

127. The apparatus of claim 126, further comprising processing circuitry, connected to the microprocessor, whereby the processing circuitry interprets the interactive subscriber input.

128. The apparatus of claims 126 or 127, further comprising a bubble memory connected to the microprocessor, the bubble memory temporarily storing the interactive subscriber input and interactive output.

129. The apparatus of any of claims 126-128, further comprising a long-term memory connected to the microprocessor, the long-term memory storing interactive data.

130. The apparatus of any of claims 126-129, wherein the interactive subscriber input and interactive output are text.

131. The apparatus of any of claims 126-130, wherein the interactive subscriber input comprises answers and the interactive output comprises questions.

132. The apparatus of any of claims 126-131, further comprising a receiver for receiving information concerning programs, and the interactive software comprising

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programming instructions for processing the information concerning programs.

133. The apparatus of claim 132, wherein the information concerning programs is received by the apparatus in a vertical blanking interval.

134. The apparatus of claim 132, wherein the information concerning programs is received by the apparatus in a program control information signal.

135. The apparatus of any of claims 132-134, wherein the information concerning programs is selected from a group consisting of quizzes, facts, geographical information, and product information.

136. The apparatus of any of claims 126-135, further comprising a modem, connected to the microprocessor, that communicates with at least one interactive service.

137. The apparatus of claim 136, wherein the interactive service is outside of the television program delivery system.

138. The apparatus of claims 136 or 137, wherein the interactive service is selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

139. The apparatus of any of claims 126-138, further comprising a modem, connected to the microprocessor, that communicates with at least one on-line database.

140. The apparatus of claim 139, wherein the on-line database is outside of the television program delivery system.

141. The apparatus of claims 139 or 140, wherein the on-line database contains data concerning one or more applications selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

142. The apparatus of any of claims 126-141, further comprising a storage device, connected to the microprocessor, capable of storing digital data.

143. The apparatus of claim 142, wherein the storage device is a CD-ROM.

144. The apparatus of claims 142 or 143, wherein the interactive software comprises programming instructions for processing the digital data stored on the storage device.

145. The apparatus of any of claims 142-144, herein the stored digital data concerns one or more applications selected from a group consisting of games,

education, encyclopedias, reference, and economics.

146. The apparatus of any of claims 142-145, further comprising a receiver for receiving information concerning programs, and the interactive software comprising:

5   programming instructions for monitoring the information concerning programs; and

                     programming instructions for triggering retrieval of the stored digital data.

147. The apparatus of claim 146, wherein the information concerning programs is
10 received by the apparatus in a vertical blanking interval.

148. The apparatus of claim 146, wherein the information concerning programs is received by the apparatus in a program control information signal.

149. The apparatus of any of claims 126-148, further comprising a remote control unit, the remote control unit comprising inputs for entering the interactive
15 subscriber input.

150. The apparatus of any of claims 126-149, further comprising a menu generator, wherein the interactive subscriber input comprises menu selections from one or more menus generated on a television by the menu generator.

151. The apparatus of any of claims 126-150, wherein the apparatus is a set top
20 terminal.

152. A hardware upgrade for enhancing the functionality of a set top converter in a television program delivery system, each set top converter having a mailbox adapted to receive electronic mail, the hardware upgrade comprising:

                     an interface for providing an electrical connection to the set top
25 converter, whereby the electronic mail is transferred from the set top converter for processing and the processed electronic mail is passed to the set top converter for display;

                     a memory for storing interactive programming instructions; and

                     at least one microprocessor connected to said memory and connected
30 to said interface for accessing the stored interactive programming instructions and for processing the electronic mail to produce processed electronic mail based on the stored interactive programming instructions.

153. The hardware upgrade according to claim 152, wherein said television

program delivery system comprises digital video.

154. The hardware upgrade according to claim 152 or 153, wherein the interface is a mailbox interface and the electronic mail is transferred between the set top converter and the mailbox interface in a serial or a parallel format.

155. The hardware upgrade according to claim 152, 153 or 154, wherein the interface comprises:

    circuitry for receiving subscriber inputs from the set top converter, wherein the received subscriber inputs include textual information that is used to produce the processed electronic mail and for transferring the processed electronic mail to the set top converter for display.

156. The hardware upgrade according to any of claims 152 to 155, for use with on-line databases, interactive services and message services outside of the television program delivery system, wherein the hardware upgrade further comprises a telephone modem connected to the at least one microprocessor and adapted to provide communications capability with the on-line databases, interactive services and message services.

157. The hardware upgrade according to claim 155, further comprising:

    a high volume memory connected to the at least one microprocessor for storing the processed electronic mail.

158. An advanced set top terminal for use with a television program delivery system comprising:

    a memory for storing menu content information;

    a receiver for receiving digitally compressed program signals and a control information stream;

    a signal processor connected to the memory and the receiver for processing the control information stream to produce processed control information, whereby the processed control information is used to update the stored menu content information to produce updated menu content information;

    a generator connected to the memory for generating message and menu displays using the updated menu content information, whereby the displays produce subscriber options for selection of other menus and television programs;

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a subscriber interface in communication with the generator for selecting messages, menus, television programs or for entry of subscriber inputs; and

a tuner connected to the interface for tuning to one of the digitally

5   compressed program signals to produce a tuned television program signal.

159. The advanced set top terminal according to claim 158, wherein said television program delivery system comprises digital video.

160. The advanced set top terminal according to claim 158 or 159, further comprising:

10   a second signal processor connected to the tuner for processing the tuned television program signal to produce a video signal and audio signal for television display and listening.

161. The advanced set top terminal according to claim 197, 198 or 199, capable of operating with an interactive electronic mail service conducted from a cable

15   headend or other remote location further comprising:

a memory for storing the interactive programming instructions;

at least one processor connected to the memory for accessing the stored interactive programming instructions and for executing the stored interactive programming instructions to produce interactive signals which

20   include electronic mail; and

a data transmitter connected to the at least one processor for transmitting the produced interactive signals to the cable headend or the other remote location.

162. The advanced set top terminal according to any of claims 158 to 161, for use

25   with on-line databases, interactive services and message services outside of the television program delivery system, wherein the hardware upgrade further comprises a telephone modem, connected to the at least one processor adapted to provide communications capability with the on-line databases, interactive services and message services.

30   163. A system to provide a subscriber electronic mail services with a remotely located computer using a series of individual menus, comprising:

an operations center for generating menu control information in digitally compressed form and transmitting said menu control information;

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a cable headend for receiving said transmitted menu control information and transmitting said transmitted menu control information to at least one television terminal; and

at least one television terminal for displaying menus on a television, wherein said at least one television terminal comprises:

a decompressor for decompressing the menu control information;

a menu generator for generating menus from the menu control information;

a subscriber interface for interactively entering information using said generated menus;

a transmitter for communicating with said cable headend;

a receiver for receiving electronic mail from said cable headend; and

a text and graphics video plane combiner for integrating the electronic mail into menus.

164. The system according to claim 163, wherein said television program delivery system comprises digital video.

165. The system according to claim 163 or 164, wherein said cable headend further comprises a network controller for providing electronic mail services.

166. The system according to claim 163, 164, or 165, wherein the hardware upgrade further comprises a telephone modem, connected to the menu generator adapted to provide communications capability with on-line databases, interactive services and message services.

167. A method for enhancing the functionality of a set top converter in a television program delivery system, each set top converter having a mailbox adapted to receive electronic mail, the method comprising the steps of:

providing an electrical connection between the set top converter and the mailbox, whereby the electronic mail is transferred from the set top converter for processing;

storing interactive programming instructions;

accessing the stored interactive programming instructions; and

processing the electronic mail to produce processed electronic mail

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based on the stored interactive programming instructions.

168. The method according to claim 167, wherein said television program delivery system comprises digital video.

169. The method of claim 167 or 168, further comprising the step of:

transferring data between the set top converter and the mailbox in either serial or parallel format.

170. The method according to claim 167, 168 or 169, wherein said step of providing an electrical connection to the set top converter further comprises:

receiving subscriber inputs from the set top converter, wherein the received subscriber inputs includes textual information that is used to produce the processed electronic mail; and

transferring the processed electronic mail to the set top converter for display.

171. The method according to any of claims 167 to 170, further comprising the step of communicating with on-line databases, interactive services and message services outside of the television program delivery system.

172. The method according to claim 170, further comprising the step of:

storing the processed electronic mail.

173. A method for using an advanced set top terminal with a television program delivery system comprising the following steps:

storing menu content information;

receiving digitally compressed program signals and a control information stream;

processing the control information stream to produce processed control information;

updating the stored menu content information to produce updated menu content information;

generating message and menu displays using the updated menu content information, whereby the menu displays produce subscriber options for selection of other menus and television programs;

selecting the other menus, the television programs or a message display; and tuning to one of the digitally compressed television programs signals to produce a tuned television program signal.

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174. The method according to claim 173, wherein said television program delivery system comprises digital video.

175. The method according to claim 173 or 174, further comprising the step of:

processing the tuned television program signal to produce a video signal and audio signal for television display and listening.

176. The method according to claim 173, 174 or 175, further comprising the steps of:

entering electronic mail into a mailbox;

storing interactive programming instructions;

accessing the stored interactive programming instructions;

executing the stored interactive programming instructions to produce electronic mail signals; and

transmitting the produced electronic mail signals to the cable headend.

177. The method according to claim 176, further comprising the step of communicating with on-line databases, interactive services and message services outside of the television program delivery system.

178. A method to provide a subscriber electronic mail services with a remotely located computer using a series of individual menus, comprising:

generating menu control information in digitally compressed form at an operations center;

transmitting said digitally compressed menu control information to a cable headend;

retransmitting said digitally compressed menu control information to at least one television terminal; and

displaying menus on a television, wherein said step of displaying further comprises the steps of:

decompressing the menu control information;

generating menus from the menu control information;

interactively entering subscriber inputs using said displayed menus;

communicating with the remotely located computer;

receiving electronic mail from the remotely located computer; and

integrating the electronic mail into menus.

179. The method according to claim 178, wherein said television program delivery

system comprises digital video.

180. The method according to claim 178 or 179, wherein the remotely located computer further comprises a network controller for providing electronic mail services.

181. The method according to claim 178, 179 or 180, further comprising the step of communicating with on-line databases, interactive services and message services outside of the television program delivery system.

182. An advanced set top terminal for use with a television program delivery system comprising:

a subscriber interface for entry of electronic mail;

at least one memory for storing the electronic mail and for storing interactive programming instructions;

at least one processor connected to the memory and the subscriber interface for accessing the stored interactive programming instructions and for executing the stored interactive programming instructions to produce interactive signals which include electronic mail; and

a data transmitter connected to the at least one processor for transmitting the produced interactive signals.

183. The advanced set top terminal according to claim 182, wherein said television program delivery system comprises digital video.

184. The advanced set top terminal according to claim 182 or 183, for use with on-line databases, interactive services and message services outside of the cable television program delivery system, further comprising a telephone modem, connected to the data transmitter adapted to provide communications capability with the on-line databases, the interactive services and the message services.

185. The advanced set top terminal according to claim 182, 183 or 184, wherein said data transmitter transmits the produced interactive signals to an operations center.

186. The advanced set top terminal according to any of claims 182 to 185, wherein said data transmitter transmits the produced interactive signals to a cable headend or other remote location.

187. A method for using an advanced set top terminal in a television program delivery system, comprising the steps of:

entering electronic mail;

storing the electronic mail;

storing interactive programming instructions;

accessing the stored interactive programming instructions;

5   executing the stored interactive programming instructions to produce interactive signals which include electronic mail; and

transmitting the produced interactive signals.

188. The method according to claim 187, wherein said television program delivery system comprises digital video.

10   189. The method according to claim 187 or 188, further comprising the step of communicating with on-line databases, interactive services and message services outside of the television program delivery system.

190. The method according to claim 187, 188 or 189, wherein said step of transmitting further comprises transmitting the produced interactive signals to an

15   operations center.

191. The method according to any of claims 187 to 190, wherein said step of transmitting further comprises transmitting the produced interactive signals to a cable headend or other remote location.

192. An apparatus for outputting a plurality of signals, comprising:

20   a plurality of tuners for tuning to a plurality of programs;

a plurality of decompressors; and

a plurality of output ports connected to the plurality of decompressors, wherein at least two of the plurality of output ports are connected to different tuners of the plurality of tuners.

25   193. An apparatus for outputting a plurality of audio signals for at least one video signal, comprising:

a plurality of tuners for tuning to a plurality of programs;

a plurality of video decompressors; and

a plurality of audio decompressors, wherein each of the plurality of

30   audio and video decompressors corresponding to and connected to the plurality of tuners and wherein the plurality of programs are comprised of both audio and video signals and wherein the at least one video signal may have more than one of the plurality of audio signals corresponding therewith.

194. The apparatus according to claim 193, further comprising a plurality of output ports connected to the plurality of decompressors, wherein at least two of the plurality of output ports are connected to different tuners of the plurality of tuners.

195. The apparatus according to claim 193 or 194, wherein the at least one video signal having at least one audio signal in a first language and at least one audio signal in a second language corresponding therewith.

196. The apparatus according to claim 193, 194 or 195, wherein the at least one video signal having at least two stereo audio signals in a first language and at least one audio signal in a second language corresponding therewith.

197. The apparatus according to any of claims 193 to 196, further comprising a switch connected to the plurality of audio decompressors, for accommodating switching between the plurality of audio decompressors.

198. An apparatus for displaying a picture on a picture, comprising:

a plurality of tuners for tuning to a plurality of programs;

a plurality of audio decompressors;

a plurality of video decompressors; and

a plurality of graphics/text decompressors, each of the plurality of audio, video and graphics/text decompressors corresponding to and connected to the plurality of tuners.

199. The apparatus according to claim 198, further comprising:

a plurality of demodulators;

a plurality of demultiplexors; and

a plurality of decryptors, wherein each of the plurality of demodulators, each of the plurality of demultiplexors and each of the plurality of decryptors are connected in series and correspond to the plurality of tuners and the plurality of decompressors.

200. The apparatus according to claim 199, further comprising a microprocessor connected to the plurality of tuners, the plurality of demultiplexors and the plurality of decryptors, for coordinating signal processing.

201. The apparatus according to claim 199 or 200, further comprising:

a plurality of video/graphics/text demultiplexors corresponding to and connected to the plurality of decryptors; and

a plurality of memory corresponding to and connected to the plurality of

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video/graphics/text demultiplexors and corresponding and connected to the plurality of video decompressors.

202. The apparatus according to any of claims 198 to 201, further comprising a combiner connected to the plurality of decompressors for combining the plurality of
5   the program signals.

203. The apparatus according to any of claims 198 to 201, further comprising a combiner connected to the plurality of decompressors for combining the plurality of the program signals wherein the combiner overlays at least one first program signal of the plurality of program signals over at least one second program signal of the
10   plurality of signals.

204. The apparatus according to any of claims 198 to 201, further comprising a combiner connected to the plurality of decompressors for combining the plurality of the program signals wherein the combiner splits a screen between at least two of the plurality of the program signals.

15   205. The apparatus according to claim 202, further comprising a plurality of NTSC encoders connected to the combiner for producing NTSC video output.

206. The apparatus according to claim 205, further comprising a plurality of RF modulators connected to and corresponding to the plurality of audio decompressors and connected to and corresponding to the plurality of NTSC encoders.

20   207. An apparatus for displaying a picture on a picture, comprising:

         a plurality of tuners for tuning to a plurality of programs, wherein the plurality of programs are comprised of both audio and video signals and wherein at least one video signal may have a plurality of audio signals corresponding therewith;

25   a plurality of decompressors connected to the plurality of tuners; and

         a plurality of output ports connected to the plurality of decompressors, wherein at least two of the plurality of output ports are connected to different tuners of the plurality of tuners.

208. An apparatus for displaying a picture on a picture according to claim 246,
30   further comprising:

         a plurality of demodulators;

         a plurality of demultiplexors;

         a plurality of decryptors, wherein the plurality of demodulators, the

plurality of demultiplexors and the plurality of decryptors are connected in series between and correspond to the plurality of tuners and the plurality of decompressors; and

a video combiner connected to the plurality of decompressors for combining the plurality of the program signals; and

209. The apparatus according to claim 208, wherein the plurality of decompressors further comprises:

a plurality of audio decompressors;

a plurality of video decompressors; and

a plurality of graphics/text decompressors.

a plurality of NTSC encoders connected to the video combiner for producing NTSC video output;

a plurality of RF modulators connected to and corresponding to the plurality of audio decompressors and connected to and corresponding to the plurality of NTSC encoders; and

a switch connected to the plurality of audio decompressors, for accommodating switching between the plurality of audio decompressors.

210. The apparatus according to claim 209, wherein the at least one video signal has at least one audio signal in a first language and at least one audio signal in a second language corresponding therewith.

211. The apparatus according to claim 209, wherein the at least one video signal has at least two stereo audio signals in a first language and at least one audio signal in a second language corresponding therewith.

212. A method for outputting a plurality of signals, comprising:

tuning to a plurality of programs;

decompressing the plurality of programs; and

outputting a plurality of decompressed signals from the plurality of programs.

213. A method for outputting a plurality of audio signals for at least one video signal, comprising:

tuning to a plurality of programs;

decompressing the plurality of audio signals from the plurality of programs;

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decompressing a plurality of video signals from the plurality of programs;

decompressing a plurality of graphics and text signals from the plurality of programs, wherein the plurality of programs are comprised of both audio and video signals and wherein the at least one video signal may have more than one of the plurality of audio signals corresponding therewith; and

214. The method according to claim 213, further comprising the step of switching between the plurality of audio signals.

215. The method according to claim 214, wherein the step of switching between the plurality of audio signals further comprises:

switching between at least one audio signal in a first language corresponding to the video signal and at least one audio signal in a second language corresponding to the video signal.

216. The method according to claim 214, wherein the step of switching between the plurality of audio signals further comprises:

switching between at least two stereo audio signals in a first language corresponding to the video signal and at least one audio signal in a second language corresponding to the video signal.

217. A method for displaying a picture on a picture, comprising:

tuning to a plurality of programs;

decompressing a plurality of audio signals from the plurality of programs;

decompressing a plurality of video signals from the plurality of programs; and

decompressing a plurality of graphics and text signals from the plurality of programs.

218. The method according to claim 217, further comprising the steps of:

demodulating the plurality of programs;

demultiplexing the plurality of programs; and

decrypting the plurality of programs.

219. The method according to claim 217 or 218, further comprising the step of:

combining the plurality of decompressed program signals.

220. The method according to claim 219, wherein the step of combining further

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comprises overlaying at least one first program signal of the plurality of program signals over at least one second program signal of the plurality of programs.

221. The method according to claim 219, wherein the step of combining further comprises splitting a screen between at least two of the plurality of the programs.

5   222. The method according to claim 219, 220 or 221, further comprising the step of:

        encoding the combined signal.

223. The method according to claim 222, further comprising the step of producing analog NTSC video waveforms from the combined signal.

10   224. The method according to claim 222 or 223, further comprising the step of modulating the encoded signal.

225. A method for displaying a picture on a picture, comprising:

        tuning to a plurality of programs;

        decompressing a plurality of audio signals from the plurality of

15   programs;

        decompressing a plurality of video signals from the plurality of programs;

        decompressing a plurality of graphics and text signals from the plurality of programs, wherein the plurality of programs are comprised of both

20   audio and video signals and wherein at least one video signal may have a plurality of audio signals corresponding therewith; and

        outputting a plurality of decompressed signals from the decompressed plurality of audio, video and graphics and text signals.

226. The method according to claim 225, further comprising:

25   demodulating the plurality of programs;

        demultiplexing the plurality of programs;

        decrypting the plurality of programs;

        combining the plurality of decompressed programs;

        encoding the combined program; and

30   modulating the encoded program.

227. The method according to claim 226, wherein the step of combining further comprises overlaying at least one first program signal of the plurality of program signals over at least one second program signal of the plurality of programs.

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228. The method according to claim 226, wherein the step of combining further comprises splitting a screen between at least two of the plurality of the programs.

229. The method according to claim 225, further comprising the step of:

switching between the plurality of audio signals.

230. The method according to claim 229, wherein the step of switching between the plurality of audio signals further comprises:

switching between at least one audio signal in a first language corresponding to the video signal and at least one audio signal in a second language corresponding to the video signal.

231. The method according to claim 229, wherein the step of switching between the plurality of audio signals further comprises:

switching between at least one audio signal in a first language corresponding to the video signal and at least one audio signal in a second language corresponding to the video signal.

232. An apparatus that outputs multiple video signals, comprising:

a first signal path having first signal processing components, wherein the first signal processing components process a first video signal, the first signal processing components also operable to scale and redirect the first video signal;

a second signal path having second signal processing components, wherein the second signal processing components process a second video signal, the second signal processing components also operable to scale and redirect the second video signal; and

a microprocessor that controls processing on the first and the second signal paths such that the first video signal and the second video signal are displayed on a display, and wherein the first signal processing components and the second signal processing components are substantially identical.

233. The apparatus of claim 232, wherein the first signal processing components comprise:

a first tuner;

a first demodulator coupled to the first tuner;

a first demultiplexor coupled to the first demodulator;

a first video/graphics/text demultiplexor coupled to the first demultiplexor, wherein the first video/graphics/text demultiplexor separates graphics, video and

text from the first video signal;

a first video decompressor coupled to the first video/graphics/text demultiplexor; and wherein the second signal processing components comprise:

a second tuner;

a second demodulator coupled to the second tuner;

a second demultiplexor coupled to the second demodulator;

a second video/graphics/text demultiplexor coupled to the second demultiplexor, wherein the second video/graphics/text demultiplexor separates graphics, video and text from the second video signal;

a second video decompressor coupled to the second video/graphics/text demultiplexor.

234. The apparatus of claim 233, further comprising a first decryptor and a first memory in the first signal path and a second decryptor and a second memory in the second signal path.

235. The apparatus of claim 232, 233 or 234, wherein a quality of the first video signal equals a quality of the second video signal.

236. The apparatus of any of claims 232 to 235, further comprising a video combiner, the video combiner combining a processed, scaled and repositioned first signal and a processed second video signal for display.

237. The apparatus of claim 236, wherein the processed, scaled and repositioned first video signal is overlaid on the processed second video signal.

238. The apparatus of claim 237, wherein a size of the overlaid first video signal is smaller than a size of the processed second video signal.

239. The apparatus of claim 236, wherein the processed second video signal is scaled and repositioned, and wherein the processed, scaled and repositioned first and second video signals are displayed in a split screen format.

240. The apparatus of claim 232, further comprising a third signal path having third signal processing components, wherein the third signal processing components process a third video signal, the third signal processing components also operable to scale and redirect the third video signal, wherein the third signal processing components are substantially identical to the first and the second signal processing components, and wherein the first, second and third video signals are displayed simultaneously on a display.

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241. The apparatus of claim 240, wherein the first and the third video signals are overlaid on the second video signal.

242. The apparatus of claim 240, wherein the first, second and third video signals are displayed in a split screen format.

243. The apparatus of claim 240, further comprising:

audio decompressors in the first, second and third signal paths; and

a switch coupled to the audio decompressors, wherein the audio decompressors provide audio signal associated with video signals, and wherein the switch operates to select an audio output from one of the audio decompressors.

244. The apparatus of claim 232, wherein processed, scaled and redirected video signals are provided as digital signals for display on a digital television.

245. The apparatus of claim 232, wherein the first signal path includes a first NTSC encoder and the second signal path includes a second NTSC encoder, the first and the second NTSC encoders operable to convert processed video signals and processed, scaled, repositioned video signals to analog format for display on an analog television.

246. The apparatus of claim 232, wherein the apparatus is an upgrade card, the upgrade card insertable into a set top terminal to provide digital picture-on-picture capability.

247. The apparatus of claim 232, wherein the apparatus is an upgrade card, the upgrade card insertable into a television to provide digital picture-on-picture capability.

248. The apparatus of claim 232, wherein the first video signal is provided to a final television and the second video signal is provided to a second television.

249. The apparatus of claim 232, wherein the second video signal is a close captioned text display that corresponds to an audio signal related to the first video signal.

250. The apparatus of claim 232, wherein the apparatus is a set top terminal.

251. The apparatus of claim 232, wherein the first signal path further includes first audio processing components and the second signal path further includes second audio processing components.

252. The apparatus of claim 232, further comprising a switch for selecting a first or a second audio signal for display, the switch activated by operation of a remote

control.

253. The apparatus of claim 252, wherein the first and the second audio signals may be provided in multiple languages, and wherein a menu of available languages is present on screen for selection of a desired language.

5   254. The apparatus of claim 252, wherein the first and the second audio signals are associated with the first video signal.

255. The apparatus of claim 252, wherein the switch is operable to select additional audio signals for display, the additional audio signals associated with the second video signal.

10   256. An apparatus that provides access to data bases in a telecommunications network, comprising:

an input that connects to the telecommunications network, the input sending connection signals to the data bases and receiving data from data bases successfully connected thereto;

15   a first memory coupled to the input that stores the data received from the data bases;

a second memory coupled to the input that stores programming instructions; and

a processor coupled to the input and the first and the second memories, the
20   processor accessing the programming instructions to send the connection signals, process the data received from the data bases and store the received data in the first memory.

257. The apparatus of claim 256, further comprising:

a display module coupled to the processor that provides a visual representation
25   of text and graphical information and an audio representation of selected data, the text and the graphical information and the selected data received from the data bases; and

an interface that provides control signals to the processor, the control signals directing the processor to execute routines for accessing the data bases and for
30   displaying the received data on the display module.

258. The apparatus of claim 257, wherein the input and the first and the second memories are contained in a set top box connected to a television, and wherein the display module includes a video display and an audio display of the television.

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259. The apparatus of claim 257 or 258, wherein the input and the first and the second memories are contained in a set top box connected to a television, and wherein the display module is contained in an electronic book coupled to the set top box.

5   260. The apparatus of claim 257, 258 or 259, wherein the input is contained in a set top box connected to a television, and wherein the second memory and the display module are contained in an electronic book capable of being connected to the set top box, the display module including a video display.

261. The apparatus of claim 260, wherein the received data from the data bases is

10   stored in a compressed manner, the data being decompressed for display on the video display.

262. The apparatus of any of claims 256 to 261, wherein the interface is a remote control, the remote control including alpha-numeric, numeric, and iconic buttons, go buttons and cursors for entering commands that direct control signals to the

15   processor.

263. The apparatus of claim 262, wherein the input connects to a specific data base when the specific data base is selected using the interface.

264. The apparatus of any of claims 256 to 263, wherein the input includes a high data-rate transfer device, the device providing two-way communication between the

20   apparatus and interactive services in the telecommunications network.

265. The apparatus of claim 264, wherein the device is a modem.

266. The apparatus of any of claims 256 to 265, wherein the second memory is one of a floppy disk, a hard disk, an optical disk and a magnetic cartridge.

267. The apparatus of any of claims 256 to 266, further comprising a menu

25   generation module coupled to the processor, the menu generation module providing a graphical menu for selecting interactive services and on-line services.

268. The apparatus of claim 267, wherein the graphical menu includes sub menus, the sub menus indicating available on-line data bases and services, a graphical icon on one of the sub menus being activated to select a desired on-line data base and a

30   desired on line service.

269. The apparatus of claim 268, wherein the input receives multimedia applications from the on-line databases and services including computer games, on-line books, and interactive customer services, the input allowing interactive

communication between the apparatus and other devices connected to the telecommunications network.

270. The apparatus of claim 269, wherein the on-line services are selected by entering data into a field of a sub menu, the data being transmitted to a provider of the on-line services.

271. The apparatus of claim 269 or 270, wherein the interactive services include an airline ticket and reservation service, the airline ticket and reservation service providing information regarding flight times, seat availability, ticket costs and availability, and allowing on-line reservation and purchase of airline tickets.

272. The apparatus of claim 269, 270, or 271, wherein the on-line services are paid for by entering credit card information into a field of a sub menu.

273. The apparatus of any of claims 269 to 272, wherein the data provided by the on-line data bases and the on-line services is encrypted, the processor decrypting the data when displaying the data on a display connected to the apparatus.

274. The apparatus of any of claims 269 to 273, wherein the on-line services include Internet service providers, the input connecting the apparatus to the Internet through the Internet service providers.

275. The apparatus of any of claims 269 to 274, wherein the processor sends electronic mail to and receives electronic mail from the other devices connected to the telecommunications network, and wherein the electronic mail is displayed on a television display.

276. The apparatus of claim 275, wherein the electronic mail is sent to the databases in the telecommunications network in response to data received from the databases.

277. The apparatus of claim 276, wherein the electronic mail is used to purchase products and services.

278. The apparatus of any of claims 256 to 277, further comprising:

a decompressor coupled to the input that decompresses compressed data; and

a converter coupled to the decompressor and the processor that converts digital data to NTSC analog signals, wherein MPEG data is converted to NTSC-compatible display devices.

279. An apparatus for connecting a television to the Internet, comprising:

an input connected to the television and a telecommunications system

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including the Internet;

a memory connected to the input, the memory storing information received from the Internet; and

a processor connected to the memory and the input, wherein the processor generates a connection signal to connect to the Internet, the input sends the connection signal to an Internet service provider, and the processor processes the information received from the Internet and displays the information on a display of the television.

280. The apparatus of claim 279, further comprising a remote control device, the remote control device sending control signals to the processor to control connection to the Internet.

281. The apparatus of claim 279 or 280, further comprising a menu generation module, the menu generation module generating a menu including icons selectable by the remote control device to connect the apparatus to the Internet.

282. The apparatus of claim 279, 280 or 281, wherein the input comprises a modem device that allows two-way communication between the apparatus and the telecommunications network.

283. A method for providing Internet access, comprising:

connecting a terminal to a television and a telecommunications network;

activating the terminal to display a graphical menu on a display of the television;

selecting from the displayed menu an Internet service provider;

sending a connection signal from the terminal to the Internet service provider, wherein the information available from the Internet service provider is displayed on the display of the television.

284. The method of claim 283, wherein the selecting and sending steps are completed using a remote control device.

285. The method of claim 284, wherein the remote control device communicates with the terminal using infra red signals.

286. A menu system for accessing data bases in a telecommunications network, comprising:

a menu generator that generates menus;

a processor that controls the menu generator;

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a memory coupled to the processor that stores the generated menus;

a display that displays the generated menus and displays data from the data bases; and

an interface device coupled to the processor, the interface device used to enter commands to navigate the generated menus, wherein the menus provide access to the data bases.

287. The menu system of claim 286, wherein the interface device includes one of a pushbutton control and a remote control.

288. The menu system of claim 287, wherein the remote control includes alpha-numeric, numeric, and iconic buttons, go buttons and cursors, and wherein the remote control is coupled to the interface device by infra-red.

289. The menu system of claim 286, 287 or 288, wherein the data bases include data bases accessed through the Internet, the generated menus including a menu displaying Internet service providers for accessing the Internet.

290. The menu system of claim 289, wherein the menu displaying Internet service providers is accessed by operation of a single push button on a remote control, the menu providing a connection to the Internet service provider by selecting a desired Internet service provider using a cursor and a select key on the remote control.

291. The menu system of any of claims 286 to 290, wherein the menu system is contained in a terminal connected to a television, and wherein the display is a television display.

292. The menu system of any of claims 286 to 291, wherein the displayed menus include video, graphics and textual information.

293. The menu system of any of claims 286 to 292, wherein the generated menus are displayed during television programming, the generated menus over laying the television programming, the processor detecting when interactive services are available with the television programming.

294. The menu system of any of claims 286 to 293, wherein the generated menus are displayed during television programming, the generated menus displayed in a picture-in-picture format during the television programming.

295. The menu system of any of claims 286 to 294, wherein the generated menus are arranged in a hierarchal order that include home menus, major menus and sub-menus, and wherein the generated menus are accessed in one of a series operation

and by bypassing intermediate menus in the hierarchal order.

296. The menu system of claim 295, wherein escape menus return the displayed menu to one of the sub-menus, the major menus and the home menus.

297. The menu system of any of claims 286 to 296, wherein the displayed menus include programming menus, selected programming menus related to corresponding television programs, the selected programming menus accessible during display of the corresponding television programs.

298. The menu system of any of claims 286 to 297, wherein the menu generation module receives control signals from a remote site to generate menu templates, the menu templates stored in the memory, the menu generation module generating menus based on the menu templates.

299. The menu system of claim 298, wherein the memory stores program instructions, and wherein the processor executes the stored program instruction to allow access to a hierarchy of menus.

300. A system for accessing on-line data bases using a cable head end, comprising:

an input in communication with the cable head end;

a processor coupled to the input;

a first memory coupled to the processor that stores programming instructions;

a second memory coupled to the processor that stores data from the cable head end; and

an interface coupled to the processor, the interface providing control signals to the processor.

301. The system of claim 300, wherein the cable head end connects to the on-line databases and wherein the cable head end sends signals to the processor to indicate available on-line data.

302. The system of claim 301, wherein the processor converts the signals into a menu that is displayed on a display.

303. The system of claim 302, wherein the display is a television display.

304. The system of claim 302 or 303, wherein the menu is displayed in an overlay fashion.

305. The system of claim 302, 303 or 304, wherein the menu is displayed in a picture-in-picture format.

306. The system of any of claims 301 to 305, wherein a desired menu is selected

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using the interface, and wherein when the selected menu is exited, programming returns to another menu or to television programming.

307. The system of claim 306, wherein at least one selected menu provides access to an Internet service provider.

308. The system of claim 306 or 307, wherein another menu is a home menu, and wherein the home menu and the television program are reached using one button on the interface.

309. An interactive communications system, comprising:

a terminal operably connected to a television tuner and a display device;

a high data-rate transfer device coupled to the terminal;

a television program delivery system, the television program delivery system sending television programming to the terminal;

at least one television program signal including a menu of available data bases in the system; and

a data service provider in two-way communication with the terminal using the high data-rate transfer device.

310. The system of claim 309, further comprising an interface useable for selecting from the menu of available data bases, wherein the selected data base is provided on the display device.

311. The system of claim 310, wherein the interface is a remote control.

312. The system of claim 311, wherein the remote control is an infra red control.

313. The system of claim 311 or 312, wherein the remote control is a radio frequency control.

314. The system of any of claims 309 to 313, wherein the selected data base is provided simultaneously with the television programming.

315. The system of claim 314, wherein the simultaneously provided data base is displayed in a picture-in-picture format.

316. The system of any of claims 309 to 315, wherein the high data-rate transfer device is a modem.

317. The system of any of claims 309 to 316, wherein the data service provider is an Internet service provider.

318. The system of any of claims 309 to 317, wherein the data service provider is a networked computer system.

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319. The system of any of claims 309 to 318, wherein the television program delivery system includes a cable television headend.

320. The system of any of claims 309 to 319, wherein the television program delivery system includes an operations center.

5 321. A method for providing interactive communications in a cable television system, comprising:

providing a television signal containing television programming and data related to interactive data bases;

receiving the television signal at a terminal coupled to a television;

10 displaying the television programming and a menu of the interactive data bases on a television display;

coupling the terminal to providers of the interactive data bases via a high data-rate transfer device;

selecting a data base from the menu;

15 connecting the terminal to the selected data base via the high data-rate transfer device; and

displaying content information from the selected data base on the television display, wherein the selecting step is performed using an interface operably coupled to the terminal and the television.

20 322. The method of claim 321, wherein the interface is a remote control, the remote control including alpha-numeric buttons, numeric buttons, iconic buttons, go buttons and cursor buttons and wherein the remote control is one of an infra red control and a radio frequency control.

323. The method of claim 322, wherein the selected data base is selected by
25 scrolling the menu using the cursor buttons and selecting a desired data base using the go buttons.

324. The method of claim 321, 322 or 323, wherein the displayed content information is displayed simultaneously with the television programming on the television display.

30 325. The method of claim 324, wherein the displayed content information is displayed in a picture-in-picture format with the television programming.

326. The method of any of claims 321 to 325, wherein the providers of the interactive data bases are Internet service providers.

327. The method of any of claims 321 to 326, further comprising overlaying a logo on the television programming for television programming having data related to the interactive data bases.

328. The method of any of claims 321 to 327, wherein the high data-rate transfer device is a modem.

329. A television schedule system, comprising:

a television program delivery system, the television program delivery system providing television signals containing television programming and television programming instructions; and

a terminal coupled to the television program delivery system and coupled to a television, the terminal comprising,

a memory, the memory storing the television programming instructions, and

a processor coupled to the memory, the processor processing the television programming according to the television programming instructions and creating television program menus and interactive data base menus, wherein the television program menus and the interactive data base menus are displayed on a display of the television.

330. The system of claim 329, further comprising an interface for selecting television programs and interactive data bases from the displayed menus.

331. The system of claim 330, wherein the interface is a remote control having alpha-numeric buttons, numeric buttons, iconic buttons, go buttons and cursor buttons, and wherein the remote control uses one of infra red signaling and radio frequency signaling.

332. A television schedule system, comprising:

a television program delivery system, the television service program delivery system sending television signals containing first data and second data, the first and the second data including television programming and connections to interactive data bases, respectively;

a terminal coupled to the television service provider, comprising:

a data input that receives the television signals,

a high data-rate transfer device that receives data from the interactive data bases,

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a memory coupled to the data input and the high data-rate transfer device and that stores the first and the second data and data from the interactive data bases, and

a processor coupled to the memory, the processor using the first and the second data to provide a menu of television programming and a menu of interactive data bases; and

a display coupled to the terminal, the display displaying the television programming, the menus and the data from the interactive data bases.

333. An upgrade module for enhancing the functionality of a decompression box for use in a television program delivery system, the upgrade module comprising:

an interface connected to the decompression box, wherein said interface receives a control information stream from the decompression box:

a demultiplexer to demultiplex the control information stream into graphics and text:

a combiner coupled to the demultiplexer, wherein the combiner combines the text and graphics to produce a menu generation signal:

means for transferring the menu generation signal to the interface for output to the decompression box, wherein the menu generation signal is processed for display; and

digital signal components that receive and process a high definition television signal.

334. The upgrade module of claim 333, further comprising a graphics decompressor connected to the combiner.

335. The upgrade module of claim 333 or 334, wherein the interface comprises:

a receiver to receive video signals from the decompression box, and wherein the combiner comprises:

means for interpreting the text and graphics:

means for integrating the received video signals, the interpreted text and graphics to produce the menu generation signal, wherein the menu generation signal carries data required for display of a program catalogue, wherein said program catalogue provides a subscriber with program schedules and descriptions: and

means for sending the menu generation signal to the transfer

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means, wherein the menu generation signal is output to the decompression box for display of the program catalogue.

336. The upgrade module of claim 333 or 334, wherein the interface comprises:

a receiver to receive video signals from the decompression box, and wherein the combiner comprises:

means for interpreting the text and graphics;

means for integrating the received video signals, the interpreted text and graphics to produce the menu generation signal, wherein the menu generation signal carries data required for display of promotional menus, where the promotional menus provide subscribers with promotional videos, text and graphics showing future events available for menu driven program selection; and

means for sending the menu generation signal to the transfer means, wherein the menu generation signal is output to the decompression box for display of the promotional menus and the promotional videos, text and graphics.

337. The upgrade module of any of claims 333 to 336, further comprising a memory to store the graphics and text for use with the menu generation signal to generate menus.

338. The upgrade module of any of claims 333 to 337, wherein the interface comprises at least one cable connector adapted for use with an upgrade port, wherein said upgrade port is coupled to the decompression box.

339. The upgrade module of any of claims 333 to 338, wherein the decompression box comprises an expansion card slot and wherein the interface comprises at least one card connector adapted for use with the expansion card slot.

340. The upgrade module of any of claims 333 to 339, further comprising:

an electronic connection to the decompression box that receives telephone signals;

means for processing the telephone signals to produce text messages and graphics icons; and

means for sending the text messages and graphics icons to the combiner, the combiner produces the menu generation signal, wherein the text messages and graphics icons form the menu generation signal transferred to

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the decompression box for display of a caller identification message.

341. The upgrade module of any of claims 333 to 340, further comprising a menu generation card, wherein the menu generation card comprises:

means for generating recording menus;

means for interpreting selection options chosen by a subscriber, wherein said selection options are received from the interface;

means for generating video cassette recorder control signals based on the interpreted selection options chosen by the subscriber; and

means for transmitting the video cassette recorder control signals to the decompression box for instructing a video cassette recorder coupled to the decompression box, in recording programs.

342. A hardware upgrade for enhancing the functionality of a set top converter in a television program delivery system, comprising:

an interface connected to the set top converter, wherein interactive subscriber inputs are transferred from the set top converter for processing and the processed interactive subscriber inputs are passed to the set top converter for display;

a memory coupled to said set top converter that stores interactive programming instructions, wherein said interactive programming instructions process the interactive subscriber inputs;

a microprocesser coupled to said set top converter that processes the interactive subscriber inputs to produce the processed interactive subscriber inputs

based on the stored interactive programming instructions; and

digital signal components that receive and process a high definition television signal.

343. The hardware upgrade of claim 342, wherein the interface comprises:

a receiver that receives the interactive subscriber inputs from the set top converter, wherein the received subscriber inputs include textual information used to produce the processed interactive subscriber inputs; and

means for transferring the processed interactive subscriber inputs to the set top converter for display.

344. The hardware upgrade of claim 342 or 343, further comprising a telephone

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modem adapted to provide communications capability with on-line databases and interactive services.

345. The hardware upgrade of claim 342, 343 or 344, further comprising:

        a memory to store digital data to produce stored digital data; and

5   means for linking the memory to the microprocesser, wherein the stored digital data is transferred to and received from the microprocesser.

346. The hardware upgrade of any of claims 342 to 345, wherein the set top converter comprises:

        an expansion card slot and wherein the interface comprises at least one

10   card connector adapted for use with the expansion card slot.

347. An upgraded set top converter for use in a television program delivery system, comprising:

        an interface connected to the set top converter;

        a demultiplexer, connected to the interface, that demultiplexes a

15   control information stream into more than one program signal component, including graphics and text, wherein the control information stream is passed to the demultiplex from the set top converter;

        an expansion card interface;

        a menu generation card electronically connected to the expansion card

20   interface, wherein said menu generation card comprises a combiner to combine the text and graphics and video signals to produce a menu generation signal, wherein the menu generation signal is output to the set top converter for display; and

        digital signal components that receive and process a high definition

25 television signal.

348. The upgraded set top converter of claim 347, further comprising a graphics decompressor connected between the demultiplexer and the combiner.

349. The upgraded set top converter of claim 347 or 348, wherein the interface comprises:

30   means for receiving the video signals, and wherein the combiner comprises:

        means for interpreting the text and graphics;

        means for integrating the video signals, wherein the interpreted

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text and graphics produce the menu generation signal, wherein the menu generation signal carries data required for display of a program catalog, wherein said program catalog provides a subscirber with program schedules and descriptions corresponding to the video signals; and

5   means for sending the menu generation signal to a transfer means, wherein the menu generation signal is output to the set top converter for display of the program catalogue, wherein said program catalog includes HDTV programs.

350. The upgraded set top converter of claim 347 or 348, wherein the interface

10   comprises:

means for receiving the video signals, and wherein the combiner comprises:

means for interpreting the text and graphics;

means for integrating promotional video signals, and the

15   interpreted text and graphics to produce the menu generation signal, wherein the menu generation signal carries data required for display of promotional menus, wherein said promotional menus provide a subscirber with the promotional video signals, text and graphics showing future events available for menu driven program selection; and

20   means for sending the menu generation signal to a transfer means, wherein the menu generation signal is output to the set top converter for display of the promotional menus, wherein said promotional menus include HDTV programs.

351. The upgraded set top converter of any of claims 347 to 350, further

25   comprising:

a connection to the set top converter to receive telephone signals from the set top converter; and

means for processing the telephone signals to produce text messages and graphics icons and for sending the text messages and graphics icons to the

30   combiner, wherein the combiner combines the text messages and graphics icons to form a menu generation signal that is transferred to the set top converter for display of the caller identification message.

352. The upgraded set top converter of any of claims 347 to 351, wherein the menu

generation card further comprises:

means for generating recording menus;

means for interpreting selection options chosen by a subscriber, wherein said selection options are received from the interface;

means for generating video cassette recorder control signals based on the interpreted selection options chosen by the subscriber; and

means for transmitting the video cassette recorder control signals to the set top converter for instructing a video cassette recorder coupled to said set top converter in recording of programs.

353. An advanced set top terminal with digital decompression and menu generation capabilities for use with a television program delivery system comprising:

means for storing menu content information;

means for receiving digitally compressed program signals and control a information stream, wherein said program signals and said control information stream carry the menu content information;

a first signal processor that processes the control information stream to produce processed control information, wherein the processed control information is used to update the stored menu content information to produce updated menu content information;

means for generating menu displays using the updated menu content information, wherein the menu displays promote subscriber options for selection of other menus and television programs;

means for selecting the other menus and television programs;

a tuner, connected to said first signal processor, that tunes to one of the digitally compressed program signals to produce a tuned television program signal;

a second signal processor that processes the tuned television program signal to produce a video signal and an audio signal for television display and listening; and

digital signal components that receive and process a high definition television signal.

354. The advanced set top terminal of claim 353, wherein the second signal processor comprises:

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a demodulator to demodulate the tuned television program signal to produce a demodulated program signal;

a demultiplexer to demultiplex the demodulated program signal to produce video signal components and audio signal components;

a video decompressor to decompress the video signal components to produce decompressed video signal components;

an audio decompressor to decompress the audio signal components to produce decompressed audio signal components;

a combiner to combine the decompressed video signal components with the stored menu content information for television display of the video signal; and

means for producing the audio signal from the decompressed audio signal components.

355. The advanced set top terminal of claim 353 or 354, further comprising multiple tuners, wherein the multiple tuners produce multiple television program signals.

356. The advanced set top terminal of claim 354 or 355, further comprising:

means for interpreting text and graphics, wherein said text and graphics are derived from the control information stream;

means for integrating the interpreted text, the interpreted graphics and the video signal to produce a menu generation signal, wherein the menu generation signal carries data required for display of a program catalogue, wherein said program catalogue provides a subscriber with program schedules and descriptions; and

means for outputting the menu generation signal for display.

357. The advanced set top terminal of claim 354 or 355, further comprising:

means for interpreting text and graphics;

means for integrating the interpreted text, the interpreted graphics and the decompressed video signal components to produce a menu generation signal, wherein the menu generation signal carries data required for display of promotional videos, wherein the promotional videos shows future events available for menu driven program selection, the future events including HDTV programs; and

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means for outputting the menu generation signal for display.

358. The advanced set top terminal of any of claims 353 to 357, wherein the means for selecting comprises:

a subscriber interface to enter interactive subscriber inputs;

a memory to store interactive programming instructions;

a microprocessor to process the stored interactive programming instructions to produce interactive signals; and

upstream data transmission means to transmit the produced interactive signals to a cable headend.

359. The advanced set top terminal of any of claims 354 to 358, further comprising:

means for receiving telephone signals;

means for processing the telephone signals to produce text messages and graphics icons using the menu content information;

a combiner to combine the text messages and graphics icons to produce a menu generation signal carrying a caller identification message for television display; and

means for preparing the menu generation signal for television display.

360. The advanced set top terminal of any of claims 353 to 358, further comprising an interface electrically connecting digital satellite processing equipment to the first signal processor.

361. A terminal coupled to a television delivery system, comprising:

a receiver to receive a program signal containing programs and a program control information signal containing program identification data and menu identification data;

a demultiplexer, coupled to the receiver, to demultiplex the received program signal into individual programs and the received program control information signal into the program identification data and the menu identification data;

an instruction memory, coupled to the demultiplexer, to store microprocessor instructions for prompting generation of menus;

a microprocessor, connected to the instruction memory, to execute the microprocessor instructions for prompting generation of menus;

a menu memory, connected to the microprocessor, to store information

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used to generate menus, wherein the menu identification data relates the program identification data to one or more specific menus;

means, connected to the microprocessor, for generating a menu from the stored information in the menu memory;

means for commanding the microprocessor to prompt the menu generating means to generate a menu for display; and

digital signal components that receive and process a high definition television signal.

362. The terminal of claim 361, wherein the means for commanding comprises a remote control for remotely commanding the microprocessor.

363. The terminal of claim 361 or 362, wherein the demultiplexed individual programs are in compressed form.

364. The terminal of claim 363, further comprising a video decompressor to decompress the individual programs.

365. The terminal of any of claims 361 to 364, wherein the individual programs are encrypted.

366.   The terminal of claim 365 further comprising:

a decryptor to decrypt one or more of the individual programs from the program signal to produce one or more decrypted programs; and

a tuner to tune to at least one of the decrypted programs for display.

367. The terminal of any of claims 361 to 366, wherein the program control information signal is in digitally compressed form and wherein the terminal further comprises a decompressor to decompress the program control information signal.

368. A terminal for use with a television, comprising:

a receiver to receive a program control information signal;

a menu memory, connected to the receiver, to store program identities and menu locations within a set of menus for the program identities;

means, connected to the menu memory, for generating menus from the set of menus, including a program identity subset menu containing program identities, wherein the means for generating uses the program identities and the menu locations for the program identities stored in the menu memory;

a processor, connected to the means, to sequence between menus within the set of menus to generate one menu at a time for display, wherein at least one of the

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generated menus is from the program identity subset menus;

means, in communication with the processor, for selecting a program by choosing a program identity from a generated menu; and

digital signal components that receive and process a high definition television signal.

369. The terminal of claim 368, wherein the displayed menu has a cursor overlay and wherein the means for selecting a program comprises a remote control device to move the cursor overlay to assist in selecting a television program identity from the displayed menu.

370. The terminal of claim 368 or 369, wherein the program control information includes time of day information and wherein the means for generating the set of menus further comprises means for generating the current time of day information on each menu.

371. The terminal of claim 368, 369 or 370, further comprising:

a memory, to store information regarding the sequence of menus within the set of menus, wherein the processor, connected to the memory, processes the stored information on sequence of menus to control the sequence between menus within the set of menus.

372. The terminal of claim 371, wherein the stored information regarding the sequence of menus is an executable processor instruction on menu sequencing.

373. The terminal of any of claims 368 to 372, wherein the generating means further comprises:

means to generate a cursor overlay controlled by a cursor signal, wherein the selecting means comprises a remote control device with directional buttons for creating and transmitting a cursor signal; and

wherein the terminal further comprises:

a remote control interface, connected to the generating means, to receive the transmitted cursor signal.

374. The terminal of any of claims 368 to 373, wherein the means for generating the set of menus includes means for providing at least one introductory menu, a home menu, and subset of major menus relating to program categories.

375. The terminal of any of claims 368 to 374, wherein a composite signal contains the program control information signal and a program signal, wherein the program

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signal is encrypted, and wherein the receiver further comprises:

an extractor, wherein the program control information signal is extracted from the composite signal.

376. The terminal of any of claims 368 to 375, wherein the menus in the set of menus are grouped in a hierarchial configuration which descends from at least one introductory menu to a home menu to a major menu subset and to the program identification menu subset,

wherein the selecting means is a remote control which generates a remote signal and comprises a plurality of menu select buttons, each menu select button corresponding to a major menu, and

wherein the processor means sequences to a major menu in response to a single activation of the corresponding menu select button,

wherein said terminal further comprises:

a remote control interface, connected to the processor means, to receive the transmitted remote signal from the remote control.

377. The terminal of any of claims 368 to 376, wherein the program control information signal contains polling request information and event identification information corresponding to each program identity, the terminal further comprising:

means for identifying event identification information for one or more selected programs;

means for storing the identified event identification information;

means, connected to the receiving means, for determining the presence of a polling request from the polling request information;

a transmitter, connected to the means for storing, wherein the stored event identification information is transmitted upon the occurrence of a polling request.

378. The set top terminal of any of claims 368 to 377, wherein the receiver comprises a telephone port.

379. The terminal of any of claims 368 to 378, wherein the receiver is a digital receiver.

380. A terminal, comprising:

a receiver to receive a combined signal including compressed video

and a program control information signal with program identities for

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processing;

a demultiplexer to demultiplex the received combined signal;

an instruction memory to store executable instructions;

means, coupled to the demultiplexer for generating menus including an introductory menu, a home menu, at least one major menu, and at least one submenu using the program identities of the program control information signal;

means, connected to the generating means, for sequencing between menus, including sequencing between the introductory menu, home menu, major menus and submenus using the executable instructions;

means for selecting a program identity from a submenu;

a video decompressor, coupled to the demultiplexer, to decompress the compressed video, wherein the decompressed video corresponds to the program identity selected from the submenu; and

digital signal components that receive and process a high definition television signal.

381. The terminal of claim 380, wherein the means for generating menus comprises a video combiner for combining video with generated submenus.

382. The terminal of claim 380 or 381, wherein the means for selecting a program identity from a submenu comprises a user interface with a plurality of buttons.

383. The terminal of claim 382, wherein the user interface further comprises a means for affecting the sequencing between menus.

384. A method for generating menu displays with a terminal and television display for use with a program delivery system, comprising:

(a) generating menu graphics for display, comprising of:

fetching background graphic files and generating background graphics,

fetching logo graphics files and generating logo graphics, and

fetching menu display and cursor graphic files and generating the menu display and cursor graphics;

(b) generating menu text for display, comprising:

fetching text files and generating menu text, and

receiving text from the text signal and generating menu text;

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(c) combining the generated menu menu graphics and the generated menu text;

(d) displaying the combined menu graphics and menu text as a menu; and

(e) receiving and processing a high definition television signal.

385. The method of claim 384, wherein the step of receiving text from the text signal comprises:

receiving a program control information signal; and

extracting the text including text for program names from the program control information signal.

386. A method for generating displays for a television with a terminal for use with a program delivery system, comprising:

(a) executing stored executable instructions to initiate generation of a menu for display;

(b) generating menu graphics for display, comprising:

fetching background graphic files and decompressing background graphics files,

fetching logo graphics files and decompressing logo graphics files, and

fetching menu display and cursor graphic files and decompressing the menu display and cursor graphics files;

(c) generating menu text for display, comprising:

fetching and decompressing long, intermediate, and short term text files;

(d) combining the generated menu graphics files and the generated menu text files;

(e) displaying the combined menu graphics and menu text files as a menu; and

(f) receiving and processing a high definition television signal.

387. The method of claim 386, wherein the combining step further comprises:

combining video from a program delivery system with the generated menu graphics and the generated menu text, comprising:

selecting a video channel,

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decompressing the video channel into video,

scaling the video to change its size, and

redirecting the video to change its projected location on the television.

5   388. The method of claim 386 or 387, further comprising:

generating a still video picture for menu display, comprising:

fetching a still video picture stored in memory, and

decompressing the still video picture.

389. A method for selecting television programs, comprising:

10   (a) determining that a packaged program signal is being received by a terminal;

(b) generating and displaying an introductory menu;

(c) awaiting subscriber key entry;

(d) determining whether to display a packaged program or generate

15   and display a menu from a set of menus based on a subscriber key entry;

(e) generating and displaying one or more menus from the set of menus, comprising:

building at least one home menu,

building at least one menu from a major menu subset, and

20   building at least one menu from a program list subset, including listing program identities;

(f) displaying on a television a selected program, wherein the selected program is determined by the subscriber key entries made during a sequence of generated menus; and

25   (g) receiving and processing a high definition television signal.

390. The method of claim 389, wherein the step of generating and displaying further comprises:

fetching a universal background graphics file for the menu;

decompressing the fetched universal background file to create the

30   menu background;

fetching the logos graphics file for the menu;

decompressing the fetched logos graphics file to create logos; and

combining the menu background and logos.

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391. The method of claim 389, wherein the step of generating and displaying the major menu comprises:

fetching universal background graphics file for an upper sash;

fetching the universal background graphics file for a lower sash;

5   decompressing the fetched universal background files to create the major menu background;

fetching network logo graphics file for the major menu;

fetching other logo graphics files for the major menu;

decompressing the fetched logos graphics files to create the major

10   menu logos;

combining the major menu background and major menu logos;

fetching the cursor highlight graphics file;

decompressing the cursor highlights graphics file to create the cursor highlights; and

15   combining the cursor highlights with the major menu background and the major menu logos.

392. The method of claim 391, wherein the step of generating and displaying the major menu further comprises:

fetching a major menu icon graphics file from memory; and

20   decompressing the major menu icon graphics file to create a major menu icon.

393. The method of claim 390 or 391, further comprising:

producing an overlay menu and one or more icons for display with the overlay menu during the display of a television program; and

25   executing software for one or more hidden menus, wherein the software is executed during display of the television program.

394. The method of claim 389, wherein the step of generating and displaying further includes:

building at least one menu from a program description subset of menus;

30   building a program order menu; and

building a program confirmation menu.

395. The method of claim 389, wherein the major menu subset of menus relates to a plurality of program categories and associated subcategories, and wherein the step

of generating and displaying further includes:

building a menu from a program subcategory subset of menus.

396. The method of claim 389, wherein the step of displaying includes:

overlaying a menu on the displayed program so that the selected program and the overlay menu are displayed simultaneously.

397. The method of claim 396, wherein the selected program contains video and the step of overlaying includes:

scaling the selected program video to change its size;

positioning the scaled program video; and

placing an overlay menu adjacent to the scaled and positioned program video.

398. The method of claim 389, wherein the step of displaying includes:

executing software to determine whether a subscriber key entry relates to displaying a hidden menu; and

generating and displaying a hidden menu in response to a subscriber key entry relating to displaying a hidden menu, as determined by the step of executing software.

399. The method of claim 389, wherein the subscriber's selected program costs a fee if viewed for more than a predetermined time period and wherein the step of displaying further includes:

running a timer for the predetermined time period;

generating an escape menu containing the timer value; and

overlaying the escape menu on the display of the selected program until the timer has expired or the subscriber exits the selected program.

400. The method of claim 399, where the subscriber has exited the selected program after the predetermined time period, the step of displaying further including:

generating and displaying a warning menu relating to the fact that the subscriber has been charged for the selected program;

monitoring subscriber key entries for a certain key entry indicating that the subscriber desires to rejoin the selected program; and

rejoining the subscriber's selected program in response to said certain key entry.

401. The method of claim 389, where the subscriber has been charged for the

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selected program and has exited the selected program prior to the program's conclusion, further including:

monitoring subscriber key entries to detect an entry corresponding to selection of the exited program;

5   identifying one or more start times when the subscriber may rejoin the exited program;

generating and displaying a rejoin menu containing reentry menu selections for rejoining the exited program, the reentry menu selections including one or more of the identified start times; and

10   allowing the subscriber to rejoin the exited program in response to a subscriber selection of a reentry menu selection.

402. The method of claim 389, wherein there is a time interval between the subscriber's selection and the beginning of the selected program, further comprising:

15   running a countdown timer for the time interval; and

generating and displaying a countdown menu, the countdown menu containing the value of the timer.

403. The method of claim 402, further comprising:

displaying the selected program upon expiration of the countdown timer.

20   404. The method of claim 389, wherein the program control information is compressed, the programs are compressed and encrypted, the step of extracting comprises decompressing the program control information, and the step of displaying comprises:

decrypting the selected program; and

25   decompressing the decrypted program.

405. A hardware upgrade for a terminal for use with a television program delivery system, the hardware upgrade comprising:

an interface to the terminal; and

a modem connected to the interface.

30   406. The hardware upgrade of claim 405, further comprising a microprocessor connected between the interface and the modem.

407. The hardware upgrade of claim 406, further comprising memory connected to the microprocessor.

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408. The hardware upgrade of claim 405, 406 or 407, wherein the modem is capable of communicating with an interactive service.

409. The hardware upgrade of claim 408, wherein the interactive service is outside of the television program delivery system.

410. The hardware upgrade of claim 408, wherein the interactive service is selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

411. The hardware upgrade of any of claims 405 to 410, wherein the modem is capable of communicating with an on-line database.

412. The hardware upgrade of claim 411, wherein the on-line database is outside of the television program delivery system.

413. The hardware upgrade of claim 411, wherein the on-line database contains data concerning one or more applications selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

414. The hardware upgrade of any of claims 405 to 413, wherein the interface to the terminal comprises a four-wire connector.

415. The hardware upgrade of any of claims 405 to 413, wherein the interface to the terminal comprises a multipin connector.

416. The hardware upgrade of claim 415, wherein the multipin connector is a multipin connector ranging from type DB9 to type DB25.

417. The hardware upgrade of any of claims 405 to 413, wherein the interface to the terminal comprises a SCSI connector.

418. A terminal for use with a television program delivery system, the terminal comprising:

a receiver adapted to receive programs; and

a first hardware upgrade comprising:

an interface to the terminal; and

a modem connected to the interface.

419. The terminal of claim 418, further comprising a display that indicates when the hardware upgrade is in use.

420. The terminal of claim 418 or 419, wherein the terminal has an expansion card slot, and wherein the interface comprises at least one card connector adapted for use

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with the expansion card slot.

421. The terminal of claim 418, 419 or 420, wherein the terminal is a set top terminal.

422. The terminal of any of claims 418 to 421, wherein the terminal is an HDTV terminal.

423. The terminal of any of claims 418 to 421, further comprising:

one or more additional hardware upgrades connected to the terminal.

424. The terminal of claim 423, wherein the first hardware upgrade and the one or more additional hardware upgrades are connected in a daisy-chain arrangement.

425. The terminal of claim 424, wherein each of the first hardware upgrade and the one or more additional hardware upgrades comprises a SCSI connector, and the daisy-chain arrangement is a SCSI daisy-chain arrangement.

424. The terminal of claim 423, wherein the first hardware upgrade and the one or more additional hardware upgrades are capable of operating simultaneously.

425. The terminal of claim 423, wherein at least one of the one or more additional hardware upgrades is selected from the group consisting of an audio program reception hardware upgrade, an interactive hardware upgrade that receives interactive subscriber input and produces interactive output, and a storage hardware upgrade.

426. A system comprising:

a television program delivery system adapted to deliver television program signals; and

a terminal comprising:

a receiver adapted to receive at least some of the television program signals; and

a hardware upgrade comprising:

an interface to the terminal; and

a modem connected to the interface.

429. The system of claim 426, wherein the television program delivery system is a cable television program delivery system.

430. The system of claim 429, wherein the cable television program delivery system comprises an operations center, the operations center transmitting one or more of the programs to the terminal.

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431. The system of claim 430, wherein the cable television program delivery system further comprises one or more headends, a particular one of the one or more headends transmitting one or more of the programs to the terminal.

432. The system of claim 426, wherein the television program delivery system is a satellite broadcast system.

433. The system of any of claims 426 to 432, wherein the terminal is an HDTV terminal.

434. A television terminal comprising:

a television program receiver;

a modem; and

an output connected to the receiver and the modem, wherein the output accepts television program signals from the receiver and data signals from the modem.

435. The television terminal of claim 434, wherein the output is a video display.

436. The television terminal of claim 434, wherein the output is a connector port.

437. The television terminal of claim 434, 435 or 436, further comprising a microprocessor connected to the modem.

438. The television terminal of claim 437, further comprising memory connected to the microprocessor.

439. The television terminal of any of claims 434 to 438, wherein the modem is capable of communicating with an interactive service.

440. The television terminal of claim 439, wherein the interactive service is outside of the television program delivery system.

441. The television terminal of claim 439, wherein the interactive service is selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

442. The television terminal of any of claims 434 to 441, wherein the modem is capable of communicating with an on-line database.

443. The television terminal of claim 442, wherein the on-line database is outside of the television program delivery system.

444. The television terminal of claim 442, wherein the on-line database contains data concerning one or more applications selected from a group consisting of home

shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

445. The television terminal of any of claims 434 to 444, wherein the television terminal is an HDTV terminal.

446. A method comprising:

receiving a television program;

receiving subscriber input;

communicating through a modem, comprising:

transmitting data based on the subscriber input; and

receiving data; and

displaying the television program and/or information based on the received data.

447. The method of claim 446, wherein the received data comprises information concerning the television program.

448. The method of claim 447, wherein the information concerning programs is selected from a group consisting of quizzes, facts, geographical information, and product information.

449. The method of claim 446, 447 or 448, wherein the communicating step further comprises:

communicating with at least one interactive service.

450. The method of claim 449, wherein the interactive service is outside of the television program delivery system.

451. The method of claim 449, wherein the interactive service is selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking, and interactive teletext.

452. The method of any of claims 446 to 450, wherein the communicating step further comprises:

communicating with at least one on-line database.

453. The method of claim 452, wherein the on-line database is outside of the television program delivery system.

454. The method of claim 452, wherein the on-line database contains data related to one or more applications selected from a group consisting of home shopping, airline reservations, news, financial information, classified advertisements, home banking,

and interactive teletext.

455. The method of any of claims 446 to 454, further comprising:

storing digital data on a storage device.

456. The method of claim 455, wherein the storage device is a disc.

457. The method of claim 456, wherein the disc is a CD.

458. The method of claim 457, wherein the CD is a CD-ROM.

459. The method of claim 455, further comprising:

processing the digital data stored on the storage device.

460. The method of claim 455, wherein the stored digital data concerns one or more applications selected from a group consisting of games, education, encyclopedias, reference, and economics.

461. The method of claim 455, wherein the received data comprises information concerning the television program, and the method further comprises:

monitoring the information concerning programs; and

retrieving the stored digital data, in response to the monitoring step.

462. The method of any of claims 446 to 461, further comprising:

remotely receiving the interactive subscriber input.

463. The method of any of claims 446 to 462, further comprising:

generating a menu on a television, wherein the subscriber input comprises menu selections.

464. A hardware upgrade for a terminal for use with a television program delivery system, the hardware upgrade comprising:

an interface to the terminal; and

a disc storage device connected to the interface.

465. The hardware upgrade of claim 464, wherein data stored on the disc storage device concerns one or more applications selected from a group consisting of games, education, encyclopedias, reference, and economics.

466. The hardware upgrade of claim 464 further comprising a microprocessor connected between the interface and the disc storage device.

467. The hardware upgrade of claim 466 further comprising programming instructions that execute on the microprocessor, wherein the programming instructions access data stored on the disc storage device.

468. The hardware upgrade of claim 467, wherein the interface to the terminal

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transfers, to the hardware upgrade, information concerning television programs, and the programming instructions comprise:

programming instructions to monitor the information concerning television programs; and

programming instructions to retrieve data stored on the disc storage device in response to the information concerning television programs.

469. The hardware upgrade of any of claims 464 to 468, wherein the interface to the terminal comprises a multipin connector.

470. The hardware upgrade of claim 469, wherein the multipin connector is a multipin connector ranging from type DB9 to type DB25.

471. The hardware upgrade of any of claims 464 to 470, wherein the interface to the terminal comprises a SCSI connector.

472. The hardware upgrade of any of claims 464 to 471, wherein the disc storage device is a compact disc storage device.

473. The hardware upgrade of claim 472, wherein the compact disc storage device is a CD-ROM device.

474. A terminal for use with a television program delivery system, the terminal comprising:

a receiver adapted to receive programs; and

a first hardware upgrade comprising:

an interface to the terminal; and

a disc storage device connected to the interface.

475. The terminal of claim 474 further comprising a display that indicates when the first hardware upgrade is in use.

476. The terminal of claim 474 or 475, wherein the terminal has an expansion card slot, and wherein the interface comprises at least one card connector adapted for use with the expansion card slot.

477. The terminal of claim 474, 475 or 476, wherein the terminal is a set top terminal.

478. The terminal of any of claims 474 to 477, wherein the terminal is an HDTV terminal.

479. The terminal of any of claims 474 to 478 further comprising:

one or more additional hardware upgrades connected to the terminal.

480. The terminal of claim 479, wherein the first hardware upgrade and the one or more additional hardware upgrades are connected in a daisy-chain arrangement.

481. The terminal of claim 480, wherein each of the first hardware upgrade and the one or more additional hardware upgrades comprises a SCSI connector, and the daisy-chain arrangement is a SCSI daisy-chain arrangement.

482. The terminal of claim 479, wherein the first hardware upgrade and the one or more additional hardware upgrades are capable of operating simultaneously.

483. The terminal of claim 479, wherein at least one of the one or more additional hardware upgrades is selected from the group consisting of an audio program reception hardware upgrade, an interactive hardware upgrade that receives interactive subscriber input and produces interactive output, and a modem hardware upgrade.

484. The terminal of any of claims 474 to 483, wherein the disc storage device is a compact disc storage device.

485. The terminal of claim 484, wherein the compact disc storage device is a CD-ROM device.

486. A system comprising:

a television program delivery system adapted to deliver television program signals; and

a terminal comprising:

a receiver adapted to receive the television program signals; and

a hardware upgrade comprising:

an interface to the terminal; and

a disc storage device connected to the interface.

487. The system of claim 486, wherein the television program delivery system is a cable television program delivery system.

488. The system of claim 487, wherein the cable television program delivery system comprises an operations center, the operations center transmitting one or more of the programs to the terminal.

489. The system of claim 487, wherein the cable television program delivery system comprises one or more headends, a particular one of the one or more headends transmitting one or more of the programs to the terminal.

490. The system of claim 486, wherein the television program delivery system is a

satellite broadcast system.

491. The system of any of claims 486 to 490, wherein the terminal is an HDTV terminal.

492. The terminal of any of claims 486 to 491, wherein the disc storage device is a compact disc storage device.

493. The terminal of claim 492, wherein the compact disc storage device is a CD-ROM device.

494. A television terminal comprising:

    a television program receiver;

    a disc storage device; and

    an output connected to the receiver and the storage device, wherein the output accepts television program signals from the receiver and data signals from the storage device.

495. The television terminal of claim 494, wherein the output is a video display.

496. The television terminal of any of claims 494 or 495, wherein the output is a connector port.

497. The television terminal of any of claims 494, 495 or 496, wherein data stored on the disc storage device concerns one or more applications selected from a group consisting of games, education, encyclopedias, reference, and economics.

498. The television terminal of any of claims 494 to 497 further comprising a microprocessor connected to the disc storage device.

499. The television terminal of claim 498 further comprising programming instructions that execute on the microprocessor, wherein the programming instructions access data stored on the disc storage device.

500. The television terminal of claim 499, wherein the interface to the terminal transfers, to the hardware upgrade, information concerning television programs, and the programming instructions comprise:

    programming instructions to monitor the information concerning television programs; and

    programming instructions to retrieve data stored on the disc storage device in response to the information concerning television programs.

501. The television terminal of any of claim 494 to 500, wherein the disc storage device is a compact disc storage device.

502. The television terminal of claim 501, wherein the compact disc storage device is a CD-ROM device.

503. A method comprising:

receiving a television program;

accessing data using a disc storage device; and

displaying the television program and/or information based on the accessed data.

504. The method of claim 503, wherein the disc storage device is a CD-ROM.

505. The method of claim 503 or 504 further comprising:

processing the data stored on the disc storage device.

506. The method of any of claims 503, 504 or 505, wherein the accessed data concerns one or more applications selected from a group consisting of games, education, encyclopedias, reference, and economics.

507. The method of any of claims 503 to 506, wherein the accessing step is performed in response to receiving the television program.

508. The method of any of claims 503 to 507 further comprising:

receiving information concerning programs;

monitoring the information concerning programs; and

wherein the accessing step is performed in response to the monitoring step.

509. The method of claim 508 wherein the information concerning programs is received in a vertical blanking interval.

510. The method of claim 508, wherein the information concerning programs is received in a program control information signal.

511. The method of any of claims 503 to 510 further comprising:

receiving subscriber input;

512. The method of claim 511 further comprising:

remotely receiving the subscriber input.

513. The method of claim 511 or 512 further comprising:

generating a menu on a television;

receiving menu selections from one or more menus, wherein the subscriber input comprises menu selections.

514. The method of claim 511, 512 or 513, wherein the accessing step is performed in response to receiving the subscriber input.

515. The method of any of claims 503 to 514, wherein the disc storage device is a compact disc storage device.

516. The method of claim 515, wherein the compact disc storage device is a CD-ROM device.

5   517. A set top terminal for use with a television, with menu selection of television programs and accompanying audio signals from a set of menus, using a program control information signal containing program identities and menu locations within the set of menus for the program identities comprising:

a receiver, wherein the program control information signal is received;

10   a menu memory, connected to the receiver, for storing the program identities and menu locations within the set of menus for the program identities;

means, connected to the menu memory, for generating menus from the set of menus, including a program identity subset menu containing program identifies, wherein the means for generating uses the program identities and the menu

15   locations for the program identities stored in the menu memory;

processor means, connected to the generating means for sequencing between menus within the set of menus to generate one menu at a time wherein at least one of the generated menus is from the program identity subset of menus; and

means, in communication with the processor means, for selecting a program

20   by choosing a program identity from a generated menu and for selecting accompanying audio from a generated menu.

518. The set top terminal of claim 517, wherein the displayed menu has a cursor overlay and wherein the means for selecting a program comprises a remote control device with directional buttons for moving the cursor overlay to assist in selecting a

25   television program identity from the displayed menu.

519. The set top terminal of claim 517, wherein the generating means further comprises a means to generate a cursor overlay controlled by a cursor signal, wherein the selecting means comprises a remote control device with directional buttons for creating and transmitting a cursor signal; the set top terminal further

30   comprising:

a remote control interface, connected to the generating means, which receives the transmitted cursor signal.

520. The set top terminal of claim 517, wherein the program control information

also includes time of day information and wherein the means for generating the set of menus further comprises means for generating the current time of day information on each menu.

521. The set top terminal of claim 517, wherein the means for generating the set of menus includes a means for providing at least one introductory menu, a home menu, and subset of major menus relating to program categories.

522. The set top terminal of claim 517, wherein a composite signal contains the program control information signal and a program signal, wherein the program signal is encrypted, and wherein the receiver further comprises:

an extractor, wherein the program control information signal is extracted from the composite signal; and

a decryptor.

523. The set top terminal of claim 517, wherein the menus in the set of menus are grouped in a hierarchical configuration which descends from at least one introductory menu to a home menu to a major menu subset and to the program identification menu subset, wherein the selecting means is a remote control which generates a remote signal and comprises a plurality of menu select buttons, each menu select button corresponding to a major menu, and wherein the processor means sequences to a major menu in response to a single activation of the corresponding menu select button, the set top terminal further comprising:

a remote control interface, connected to the processor means, which receives the transmitted remote signal from the remote control.

524. The set top terminal of claim 517, wherein the receiver comprises: a telephone port.

525. The set top terminal of claim 517, wherein the receiver is a digital receiver.

526. The set top terminal of claim 517, wherein the accompanying audio signals comprise audio signals in different languages.

527. The set top terminal of claim 517, wherein the program identities comprise accompanying audio signal identities.

528. A method of set top terminal menu generation and sequencing for selecting television programs to display on a television and for selecting one or more audio signals to accompany the selected program, where the set top terminal receives a packaged program signal the method comprising the steps of:

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determining that a packaged program signal is being received by the set top terminal;

generating and displaying an introductory menu;

awaiting subscriber key entry;

5   determining whether to display a packaged program or generate and display a menu from a set of menus based on a subscriber key entry;

generating and displaying one or more menus from the set of menus including the steps of building at least one menu with audio selections;

displaying on the television a selected program, wherein the selected program

10   is determined by subscriber entries made during a sequence of generated menus; and

sounding one or more audio signals determined by subscriber entries made on the at least one menu with audio selections.

529. The method of claim 528, wherein the step of generating and displaying

15   further comprises the steps of:

fetching the universal background graphics file for the menu;

decompressing the fetched universal background file to create the menu background;

fetching the logos graphics file for the menu;

20   decompressing the fetched logos graphics file to create logos; and

combining the menu background and logos.

530. The method of claim 528 further comprising the steps of:

producing an overlay menu and one or more icons for display with the overlay menu during the display of a television program; and

25   executing software at the microprocessor for one or more hidden menus, wherein the software is executed during display of the television program.

531. The method of claim 528, wherein the step of generating and displaying further includes the steps of: building at least one menu from a program description subset of menus;

30   building a program order menu; and

building a program confirmation menu.

532. The method of claim 528, wherein the step of displaying includes the step of:

overlaying a menu on the displayed program so that the selected program and

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the overlay menu are displayed simultaneously.

533. The method of claim 532, wherein the selected program contains video and the step of overlaying includes the steps of:

scaling the selected program video to change its size; positioning the scaled program video; placing an overlay menu adjacent to the scaled and positioned program video.

534. The method of claim 528, wherein the step of displaying includes the steps of:

executing software to determine whether a subscriber key entry relates to displaying a hidden menu;

generating and displaying a hidden menu in response to a subscriber key entry relating to displaying a hidden menu, as determined by the step of executing software.

535. The method of claim 528, wherein the subscriber's selected program costs a fee if viewed for more than a predetermined time period and wherein the step of displaying further includes the step of:

running a timer for the predetermined time period;

generating an escape menu containing the timer value;

overlaying the escape menu on the display of the selected program until the timer has expired or the subscriber exits the selected program.

536. The method of claim 528, wherein the program control information is compressed, the programs are compressed and encrypted, the step of extracting comprises the step of decompressing the program control information, and the step of displaying comprises the steps of:

decrypting the selected program; and

decompressing the decrypted program.

537. The method of claim 528, wherein the one or more audio signals comprise a plurality of languages.

538. A method for overlaying a menu over video for display of an overlay menu on a television, wherein the method is used with a set top terminal with menu generation and program control information, comprising the steps of:

acquiring a video signal for display of video;

generating an overlay menu signal to display the overlay menu using the program control information signal, wherein the overlay menu comprises

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programming options, including program audio options;

combining the video signal and the overlay menu signal;

displaying the combined video and overlay menu; and

wherein the step of generating an overlay menu includes the step of generating

5 a graphic for inclusion into the overlay menu signal.

539. A method for overlaying a menu over video for display on a television screen, comprising the steps of:

acquiring video for display;

generating an overlay menu for display;

10 combining the video and the overlay menu; and

displaying the combined video and overlay menu, wherein the overlay menu comprises programming options, including audio options for the video, that are accessed while viewing the video.

540. The method of claim 539, wherein the audio options are accessed by button

15 selection.

541. The method of claim 539, wherein the audio options are accessed through cursor movement on the screen.

542. The method of claim 539, wherein the audio options are accessed with a remote control.

20 543. The method of claim 539, wherein the overlay menu is generated using a program control information signal.

544. The method of claim 539, further comprising the step of:

scaling down the video so that the video fills a first portion of the screen and the overlay menu fills a second portion of the screen.

25 545. The method of claim 539, further comprising the step of:

adjusting the size of the overlay menu, wherein the adjusted size of the overlay menu determines how much of the screen and of the video the overlay menu covers.

546. The method of claim 539, further comprising the step of:

30 receiving a digital program signal; and

wherein the acquiring step acquires the video signal from the digital program signal.

547. The method of claim 539, wherein the step of generating an overlay menu

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comprises the step of generating a graphic for inclusion into the overlay menu signal so that the displayed overlay menu includes the graphic.

548. The method of claim 547, wherein the graphic includes a logo.

549. The method of claim 547, wherein the graphic includes an icon and audio options are accessed using the icon.

550. The method of claim 539, wherein the audio options comprise language options.

551. A method for overlaying an audio selection menu over video for display on a television screen, comprising the steps of:

acquiring a video signal for display of video;

generating an overlay menu signal to display the audio selection menu;

scaling the video so that the video fills a first portion of a screen;

combining the video signal and the overlay menu signal, wherein the video and overlay menu are combined; and

displaying the combined video and overlay menu, wherein the overlay menu fills a second portion of the screen.

552. The method of claim 551, wherein the first portion is larger than the second portion so that the video fills a larger amount of the screen than the overlay menu.

553. The method of claim 551, wherein the scaling step includes:

determining the comparative importance of the overlay menu and the video,

wherein the comparative importance of the overlay menu determines the size of the scaled video.

554. A method for displaying an audio selection menu with video on a television screen, comprising the steps of:

acquiring video for display;

generating a menu for display, wherein the menu has a video window and comprises audio options;

combining the video and the menu; and

displaying the combined video and menu, wherein the video is displayed within the video window of the menu.

555. The method of claim 554, wherein the combining step comprises:

scaling the video and redirecting the scaled video to the video window of the menu.

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556. A method for displaying a during program menu on a television screen, comprising the steps of:

acquiring a video signal for display of video;

generating a during program menu signal to display the during program menu using a program control information signal;

combining the video signal and the during program menu signal, wherein the video and the during program menu are combined; and

displaying the combined video and during program menu, wherein the during program menu comprises audio options for play with the video signal.

557. A method for displaying an overlay menu with a program on a television, comprising the steps of:

displaying the program on the television; and

producing an overlay menu so that the displayed program and the overlay menu are displayed simultaneously, wherein the overlay menu comprises programming options, including audio options for viewing.

558. An apparatus for increasing the functionality of a set top converter for use with a program delivery system, comprising:

a circuit card, electronically connected to a set top converter, wherein information and data is passed between the circuit card and the set top converter, comprising:

a means for generating menus, wherein the menus identify programs and channels and audio to accompany the programs;

a means for sequencing through menus; and

a means for selecting a program or channel through the generated menus in response to a user command.

559. The apparatus of claim 558, wherein the circuit card further comprises a means for interpreting a program control information signal, wherein the program control information signal is used by the generating means to generate menus.

560. A method for utilizing a program delivery system which implements a menu system, comprising the steps of:

generating menus, wherein the menus identify programs or channels and wherein the menus identify audio signals for the programs of channels;

sequencing through the generated menus, whereby additional programs or

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channels may be accessed;

receiving one or more user commands, wherein a user command indicates a desired program or channel and wherein a user command indicates a desired audio signal for the program or channel;

5   selecting the desired program or channel in response to a user command; and

selecting the desired audio in response to a user command.

561. The method of claim 560, further comprising the steps of:

receiving a program control information signal, wherein the program control information signal contains information about available programs or channels and

10   available audio signals for the programs or channels; and

interpreting the received program control information signal, wherein the interpreted program control information signal is used in the generating menus step.

562. A method for utilizing a program delivery system which implements a menu system, comprising the steps of:

15   storing menu generation instructions;

storing a program control information signal, wherein the program control information signal contains information about available programs or channels and available audio tracks for the programs or signals;

executing the stored menu generation instructions;

20   generating menus using the stored program control information signal and the executed menu generation instructions; and

communicating the generated menus to a set top converter for display on a television.

563. The method of claim 562, wherein the menus contain menu graphics, the

25   method further comprising the step of generating menu graphics for inclusion in the generated menus.

564. The method of claim 562, further comprising the steps of:

receiving a video from the set top converter; and

combining a generated menu and the received video.

30   565. The method of claim 562, wherein the menus are generated with three separate video signals each having a different color, the method further comprising the step of converting the three separate video signals into a single video signal.

566. The method of claim 562, further comprising the step of communicating

commands to the set top converter.

567. The method of claim 562, further comprising the steps of:

receiving commands from the set top converter;

modifying the received commands; and

communicating the modified commands to the set top converter.

568. The method of claim 562, wherein the audio signals comprise audio signals of different languages for the programs or channels.

569. An upgraded set top converter for use in a cable television program delivery system, the set top converter upgraded for enhanced functionality that provides the set top converter with menu generation capability using a control information stream received from a remote location, the upgraded set top converter comprising:

an expansion card interface means for providing an electronic connection; and

a menu generation card, electronically connected to the expansion card interface means, comprising a means for processing the control information stream to produce a menu generation signal, whereby the menu generation signal is output through the expansion card interface means to be processed for display, wherein a generated menu contains multiple audio choices for a given program.

570. The upgraded set top converter of claim 569, wherein the menu generation card further comprises means for demultiplexing the control information stream into more than one signal component including graphics and text; and means for combining the demultiplexed text and graphics to produce the menu generation signal.

571. The upgraded set top converter of claim 569, wherein the multiple audio choices comprise audio choices of different languages.

572. An apparatus for enhancing the functionality of a set top converter for use in a television program delivery system, wherein the apparatus uses a control information stream received from a remote location to provide the set top converter with menu generation capability, the set top converter having the capability to produce decompressed video, comprising:

an interface means for providing an electronic connection to the set top converter so that the control information stream may be received by the apparatus from the set top converter;

a means, connected to the interface means, for demultiplexing the control

information stream into graphics and text; and

a means, connected to the demultiplexing means, for combining the text and graphics to produce a menu generation signal, the menu generation signal containing data regarding menus for selecting from multiple audio signals for the same video signal;

whereby the menu generation signal is processed by the set top converter for display.

573. The apparatus of claim 572, capable of receiving the control information stream through a satellite system, the apparatus further comprising:

a satellite system, wherein the satellite system receives the control information stream from the remote location and sends the control information stream to the set top converter, and wherein the satellite system is electronically connected to the set top converter.

574. The apparatus of claim 572, wherein the multiple audio signals comprise different languages.

575. An apparatus for providing digital program signals to subscriber locations, capable of inserting local availability signals and selecting digital program signals and accompanying audio signals received from outside sources, comprising:

a means for receiving digital program signals;

digital logic circuitry, connected to the receiving means, wherein digital program signals may be inserted and wherein digital programs may be selected;

a processor, operably connected to the digital logic circuitry, wherein insertion of local availability signals are controlled and wherein the selection of digital program signals and accompanying audio signals are controlled; and

means for sending programs, operably connected to the digital logic circuitry, wherein digital program signals are sent to subscriber locations, and wherein digital program signals and accompanying audio signals that have been inserted or selected are sent to subscriber locations.

576. The apparatus of claim 575, wherein the digital logic circuitry comprises a combiner, wherein digital program signals are combined.

577. The apparatus of claim 575, wherein the digital logic circuitry comprises a local inserter, wherein local availability signals are inserted to be sent to subscriber locations.

578. The apparatus of claim 575, wherein the audio signals comprise audio signals in different languages.

579. A method for accommodating language preferences of subscribers in a program delivery system, wherein multiple audio signals correspond to the same program and wherein the multiple audio signals comprise signals of multiple languages, the method comprising:

    accepting a language selection from a subscriber; and

    generating one or more menus of programs available in the selected language.

580. The method of claim 579, wherein the programs are audio-visual programs.

581. The method of claim 580, wherein the audio-visual programs are television programs.

582. The method of claim 579, wherein the multiple languages are selected from the group consisting of English, French and Spanish.

583. The method of claim 579, wherein the number of multiple audio signals is four.

584. The method of claim 583, wherein the multiple audio signals comprise an English stereo pair and two mono foreign language signals.

585. The method of claim 583, wherein the multiple audio signals comprise an English mono signal and three mono foreign language signals.

586. The method of claim 579, wherein the language selection from the subscriber is the subscriber's native language.

587. The method of claim 579 further comprising:

    choosing the correct audio signals from among the multiple audio signals to correspond to the selected language.

588. The method of claim 587, wherein the choosing step is performed by a set top terminal.

589. The method of claim 587, wherein the choosing step is performed by a network controller in the program delivery system.

590. The method of claim 579, wherein the accepting step comprises:

    presenting one or more questions to the subscriber; and

    accepting answers to the one or more questions.

591. The method of claim 590, wherein the presenting step comprises:

    generating one or more menu screens containing the one or more questions to

the subscriber.

592. The method of claim 590, wherein the one or more questions relate to a personal profile of the subscriber.

593. The method of claim 592, wherein at least one of the one or more questions relate to the subscriber's place of birth.

594. The method of claim 592, wherein at least one of the one or more questions relate to the subscriber's place of education.

595. The method of claim 594, wherein the subscriber's place of education is the subscriber's place of lower school education.

596. The method of claim 590, wherein the one or more questions relate to demographic information about the subscriber.

597. The method of claim 579, wherein the accepting step comprises:

generating a menu of language choices; and

accepting a selection of a language from the menu.

598. A set top terminal for use with a television, with menu selection of television programs from a set of menus containing programs with audio in a desired language, using a program control information signal containing program identities and menu locations within the set of menus for the program identities comprising:

a receiver, wherein the program control information signal is received;

a menu memory, connected to the receiver, for storing the program identities and menu locations within the set of menus for the program identities;

means, connected to the menu memory, for generating menus from the set of menus, including a program identity subset menu containing program identities, wherein the means for generating uses the program identities and the menu locations for the program identities stored in the menu memory;

processor means, connected to the generating means for sequencing between menus within the set of menus to generate one menu at a time wherein at least one of the generated menus is from the program identity subset of menus; and

means, in communication with the processor means, for selecting a program having audio in the desired language by choosing a program identity from a generated menu.

599. The set top terminal of claim 598, wherein the generating means further

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comprises a means to generate a cursor overlay controlled by a cursor signal, wherein the selecting means comprises a remote control device with directional buttons for creating and transmitting a cursor signal; the set top terminal further comprising:

5   a remote control interface, connected to the generating means, which receives the transmitted cursor signal.

600. The set top terminal of claim 598, wherein the means for generating the set of menus includes a means for providing at least one introductory menu, a home menu, and subset of major menus relating to program categories.

10   601. The set top terminal of claim 598, wherein a composite signal contains the program control information signal and a program signal, wherein the program signal is encrypted, and wherein the receiver further comprises:

an extractor, wherein the program control information signal is extracted from the composite signal; and

15   a decryptor.

602. The set top terminal of claim 598, wherein the menus in the set of menus are grouped in a hierarchical configuration which descends from at least one introductory menu to a home menu to a major menu subset and to the program identification menu subset, wherein the selecting means is a remote control which

20   generates a remote signal and comprises a plurality of menu select buttons, each menu select button corresponding to a major menu, and wherein the processor means sequences to a major menu in response to a single activation of the corresponding menu select button, the set top terminal further comprising:

a remote control interface, connected to the processor means, which receives

25   the transmitted remote signal from the remote control.

603. The set top terminal of claim 598, wherein the receiver is a digital receiver.

604. A method of set top terminal menu generation and sequencing for selecting television programs to display on a television, where the set top terminal receives a packaged program signal the method comprising the steps of:

30   determining that a packaged program signal is being received by the set top terminal;

generating and displaying an introductory menu;

awaiting subscriber key entry;

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determining whether to display a packaged program or generate and display a menu from a set of menus based on a subscriber key entry;

generating and displaying one or more menus from the set of menus including the steps of building at least one menu containing programs available with audio in a desired language;

displaying on the television a selected program, wherein the selected program is determined by subscriber entries made during a sequence of generated menus; and

sounding one or more audio signals in the desired language.

605. The method of claim 604, wherein the step of generating and displaying further comprises the steps of:

fetching the universal background graphics file for the menu;

decompressing the fetched universal background file to create the menu background;

fetching the logos graphics file for the menu;

decompressing the fetched logos graphics file to create logos; and

combining the menu background and logos.

606. The method of claim 604, wherein the step of generating and displaying further includes the steps of:

building at least one menu from a program description subset of menus;

building a program order menu; and

building a program confirmation menu.

607. The method of claim 604, wherein the step of displaying includes the step of:

overlaying a menu on the displayed program so that the selected program and the overlay menu are displayed simultaneously.

608. The method of claim 604, wherein the selected program contains video and the step of overlaying includes the step of:

scaling the selected program video to change its size; positioning the scaled program video; placing an overlay menu adjacent to the scaled and positioned program video.

609. The method of claim 604, wherein the step of displaying includes the steps of:

executing software to determine whether a subscriber key entry relates to displaying a hidden menu;

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generating and displaying a hidden menu in response to a subscriber key entry relating to displaying a hidden menu, as determined by the step of executing software.

610. The method of claim 604, wherein the subscriber's selected program costs a fee if viewed for more than a predetermined time period and wherein the step of displaying further includes the step of:

running a timer for the predetermined time period;

generating an escape menu containing the timer value;

overlaying the escape menu on the display of the selected program until the timer has expired or the subscriber exits the selected program.

611. The method of claim 604, wherein the program control information is compressed, the programs are compressed and encrypted, the step of extracting comprises the step of decompressing the program control information, and the step of displaying comprises the step of:

decrypting the selected program.

612. A method for utilizing a program delivery system which implements a menu system, comprising the steps of:

storing menu generation instructions;

storing a program control information signal, wherein the program control information signal contains information about available programs or channels having an audio track in a desired language;

executing the stored menu generation instructions;

generating menus using the stored program control information signal and the executed menu generation instructions; and

communicating the generated menus to a set top converter for display on a television.

613. The method of claim 612, wherein the menus contain menu graphics, the method further comprising the step of generating menu graphics for inclusion in the generated menus.

614. The method of claim 612, further comprising the steps of:

receiving a video from the set top converter; and

combining a generated menu and the received video.

615. The method of claim 612, further comprising the step of communicating

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commands to the set top converter.

616. An apparatus for enhancing the functionality of a set top converter for use in a television program delivery system, wherein the apparatus uses a control information stream received from a remote location to provide the set top converter with menu generation capability, the set top converter having the capability to produce decompressed video, comprising:

an interface means for providing an electronic connection to the set top converter so that the control information stream may be received by the apparatus from the set top converter;

a means, connected to the interface means, for demultiplexing the control information stream into graphics and text; and

a means, connected to the demultiplexing means, for combining the text and graphics to produce a menu generation signal, the menu generation signal containing data regarding menus for selecting from programs in a desired audio language;

whereby the menu generation signal is processed by the set top converter for display.

617. The apparatus of claim 616, capable of receiving the control information stream through a satellite system, the apparatus further comprising:

a satellite system, wherein the satellite system receives the control information stream from the remote location and sends the control information stream to the set top converter, and wherein the satellite system is electronically connected to the set top converter.

618. An apparatus for providing digital program signals to subscriber locations, capable of inserting local availability signals and selecting digital program signals with accompanying audio signals in a desired language, comprising:

a means for receiving digital program signals;

digital logic circuitry, connected to the receiving means, wherein digital program signals may be inserted and wherein digital programs may be selected;

a processor, operably connected to the digital logic circuitry, wherein insertion of local availability signals are controlled and wherein the selection of digital program signals and accompanying audio signals are controlled; and

means for sending programs, operably connected to the digital logic circuitry,

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wherein digital program signals are sent to subscriber locations, and wherein the digital program signals are accompanied audio signals in the desired language.

619. The apparatus of claim 618, wherein the digital logic circuitry comprises a combiner, wherein digital program signals are combined.

5   620. The apparatus of claim 618, wherein the digital logic circuitry comprises a local inserter, wherein local availability signals are inserted to be sent to subscriber locations.

621. The apparatus of claim 618, wherein the audio signals comprise audio signals in different languages.

10   622. A method for overlaying a menu over video for display on a television screen, comprising the steps of:

acquiring video for display;

·   generating an overlay menu for display;

combining the video and the overlay menu; and

15   displaying the combined video and overlay menu, wherein the overlay menu comprises programming options, including programs having audio in a desired language.

623. The method of claim 622, wherein the audio options are accessed by button selection.

20   624. The method of claim 622, wherein the programming options are accessed through cursor movement on the screen.

625. The method of claim 622, wherein the audio options are accessed with a remote control.

626. The method of claim 622, wherein the overlay menu is generated using a

25   program control information signal.

627. The method of claim 622, further comprising the step of:

receiving a digital program signal; and

wherein the acquiring step acquires the video signal from the digital program signal.

30   628. The method of claim 622, wherein the step of generating an overlay menu comprises the step of generating a graphic for inclusion into the overlay menu signal so that the displayed overlay menu includes the graphic.

629. The method of claim 628, wherein the graphic includes a logo.

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630. A method for displaying a during program menu on a television screen, comprising the steps of:

acquiring a video signal for display of video;

generating a during program menu signal to display the during program menu

5   using a program control information signal;

combining the video signal and the during program menu signal, wherein the video and the during program menu are combined; and

displaying the combined video and during program menu, wherein the during program menu comprises program options with audio available in a desired

10   language.

631. A set top terminal used by subscribers of a television program delivery system for suggesting programs to subscribers using program control information containing program description data, and subscriber specific data, the set top terminal comprising:

15   a means for gathering the subscriber specific data to be used in selecting programs, wherein the subscriber specific data includes a language selection;

a means, connected to the gathering means, for storing the subscriber specific data;

means for receiving the program control information containing the program

20   description data;

program selection means, operably connected to the storing means and the receiving means, for selecting one or more programs using a subscriber's programming preferences and the program control information, comprising:

a processor, wherein the subscriber programming preferences are

25   generated from the subscriber specific data; and

means, operably connected to the program selection means, for suggesting the selected programs to the subscriber.

632. The set top terminal of claim 631, wherein the means for gathering the subscriber specific data comprises a means for obtaining the subscriber specific data

30   from a remote location.

633. The apparatus of claim 631, wherein the program selection means resides within a set top terminal.

634. The set top terminal of claim 631, wherein the set top terminal receives menu
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details from the television program delivery system, a display is used, and wherein the means for gathering subscriber specific data comprises:

a memory device for storing received menu details;

a means, connected to the memory device, for generating menu screens by integrating the program control information with the stored menu details;

a means, connected to the generating means, for eliciting subscriber responses using the generated menu screens; and

a subscriber interface means for entering subscriber responses.

635. The set top terminal of claim 634, wherein the stored menu details include a cursor overlay, the means for generating menu screens comprises a means for generating the cursor overlay, the generated menu screens are displayed on the display, and wherein the subscriber interface means comprises a means for moving the generated cursor overlay on the displayed menu screens.

636. The set top terminal of claim 634, wherein a display is used and wherein the set top terminal receives program signals, the set top terminal further comprising a means for generating a signal identifying a selected program's location on the received program signal.

637. The set top terminal of claim 634, wherein the subscriber specific data is user preference data.

638. A method used by a set top terminal for a television program delivery system for suggesting programs to subscribers for display on a television using program control information and subscriber specific data, the method comprising:

gathering subscriber specific data to be used in selecting programs, wherein the subscriber specific data includes a language selection;

storing the gathered subscriber specific data;

receiving program control information to be used in selecting programs;

selecting one or more programs using a subscriber's programming preferences and the received program control information, wherein the subscriber programming preferences are generated from the subscriber specific data; and

suggesting the selected programs to the subscriber.

639. The method of claim 638, wherein a display is used and wherein the set top terminal generates menus based on menu details received over the program television delivery system further comprising the following steps:

storing the received menu details;

generating menu screens using the stored menu details by integrating the received program control information with the stored menu details;

displaying menu screens whereby the menu screens identify the selected

5   programs; and

receiving subscriber responses to the displayed menu screens.

640. A set top terminal used by subscribers of a television program delivery system for suggesting programs through the use of program control information and program watched data indicative of a subscriber's most watched programs, the set

10   top terminal comprising:

a means for receiving program control information;

a means for gathering the program watched data, wherein the program watched data includes language selection data;

a memory means for storing the gathered program watched data;

15   a program selection means, operably connected to the memory means and the receiving means, for selecting a program using the stored program watched data and the received program control information;

a means, operably connected to the program selection means, for displaying the selected program.

20   641. A network controller, adapted for remotely controlling a plurality of set top terminals in a television program delivery system, for suggesting programs to subscribers by making program suggestions using subscriber specific data and program control information received from a remotely located source containing program description data, wherein the suggested programs are transmitted to the set

25   top terminal, the network controller comprising:

a means for receiving the program control information containing program description data;

a means for gathering the subscriber specific data from a set top terminal, wherein the subscriber specific data includes a language selection;

30   a means, connected to the gathering means, for storing the subscriber specific data;

a means, operably connected to the receiving means and the storing means, for suggesting one or more programs using a subscriber's programming preferences and

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the received program control information, comprising:

a processor, wherein the subscriber programming preferences are generated from the subscriber specific data; and

a means, connected to the suggesting means, for transmitting the suggested programs to the set top terminal for presentation to the subscriber.

642. An apparatus for suggesting programs to subscribers using program control information containing program description data, and subscriber specific data, the apparatus comprising:

a means for gathering the subscriber specific data to be used in selecting programs, wherein the subscriber specific data includes a language selection;

a means, connected to the gathering means, for storing the subscriber specific data;

a means for receiving the program control information; and

a program selection means, operably connected to the storing means and the receiving means, for selecting one or more programs using a subscriber's programming preferences and the program control information, comprising:

a processor, wherein the subscriber programming preferences are generated from the subscriber specific data.

643. A method for suggesting programs to subscribers using program control information containing program description data, and subscriber specific data, the method comprising:

gathering the subscriber specific data to be used in selecting programs, wherein the subscriber specific data includes a language selection;

storing the subscriber specific data;

receiving the program control information; and

selecting one or more programs using a subscriber's programming preferences and the program control information, wherein the subscriber's programming preferences are generated from the subscriber specific data.

644. A method for automatically pausing a video program in response to an occurrence of an event, comprising:

receiving a video program and outputting the video program for presentation on a display device;

detecting occurrence of a communications event during the video program;

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pausing the video program in response to the detection of the occurrence of the communications event; and

outputting a signal for displaying an indication of the occurrence of the communications event.

645. The method of claim 644, wherein the detecting step includes detecting an incoming telephone call.

646. The method of claim 645, wherein the outputting the signal step includes outputting the signal for displaying a telephone number associated with the incoming telephone call.

647. The method of claim 646, wherein the outputting the signal step includes outputting the signal for displaying a text message associated with the telephone number.

648. The method of claim 646, wherein the outputting the signal step includes outputting the signal for displaying a graphic associated with the telephone number.

649. The method of claim 644, wherein the detecting step includes detecting an incoming e-mail message.

650. The method of claim 649, wherein the outputting the signal step includes outputting the e-mail message for presentation on the display device.

651. The method of claim 644, wherein the detecting step includes detecting an incoming message.

652. The method of claim 651, wherein the outputting the signal step includes outputting the message for presentation on the display device.

653. The method of claim 644, wherein the detecting step includes detecting an incoming web page.

654. The method of claim 653, wherein the outputting step includes outputting the web page for presentation on the display device.

655. The method of claim 644, further including:

receiving a play signal to restart the video program; and

transmitting, in response to the play signal, the video program for presentation on the display device starting at an approximate location where the video program was paused.

656. The method of claim 655, further including:

receiving a fast forward signal to increase a rate of transmission of the video

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program; and

transmitting, in response to the fast forward signal, video program at an increased rate for presentation of an increased rate of display of the video program on the display device.

5   657. The method of claim 655, further including:

receiving a rewind signal to reverse a rate of transmission of the video program; and

transmitting, in response to the rewind signal, the video program at a reversed rate for presentation of a reversed rate of display of the video program on the

10   display device.

658. The method of claim 655, further including:

receiving a slow motion signal to decrease a rate of transmission of the video program; and

transmitting, in response to the slow motion signal, the video program at an

15   decreased rate for presentation of a decreased rate of display of the video program on the display device.

659. The method of claim 644, further including:

receiving a frame forward signal to display a next frame of the video program; and

20   transmitting, in response to the frame forward signal, a next frame of the video program for presentation of the next frame on the display device.

660. The method of claim 644, further including:

receiving a frame back signal to display a previous frame of the video program; and

25   transmitting, in response to the frame back signal, a previous frame of the video program for presentation of the previous frame on the display device.

661. The method of claim 655, further including:

receiving a jump signal to display the video program from a current point of transmission; and

30   transmitting, in response to the jump signal, the video program for presentation of the video program from the current point of transmission on the display device.

662. The method of claim 644, wherein the receiving step includes receiving

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information to associate with a particular phone number.

663. The method of claim 662, wherein the receiving information step includes receiving textual information or graphical information.

664. The method of claim 662, wherein:

the detecting step includes detecting occurrence of an incoming telephone call associated with the particular phone number; and

the outputting step includes outputting the signal for displaying the information associated with the particular phone number.

665. An apparatus for automatically pausing a video program in response to an occurrence of an event, comprising:

a receive module for receiving a video program and outputting the video program for presentation on a display device;

a detection module for detecting occurrence of a communications event during the video program;

a pause module for pausing the video program in response to the detection of the occurrence of the communications event; and

an output module for outputting a signal for displaying an indication of the occurrence of the communications event.

666. The apparatus of claim 665, wherein the detection module includes a module for detecting an incoming telephone call.

667. The apparatus of claim 666, wherein the output module includes a module for outputting the signal for displaying a telephone number associated with the incoming telephone call.

668. The apparatus of claim 667, wherein the output module includes a module for outputting the signal for displaying a text message associated with the telephone number.

669. The apparatus of claim 667, wherein the output module includes a module for outputting the signal for displaying a graphic associated with the telephone number.

670. The apparatus of claim 665, wherein the detection module includes a module for detecting an incoming e-mail message.

671. The apparatus of claim 670, wherein the output module includes a module for outputting the e-mail message for presentation on the display device.

672. The apparatus of claim 665, wherein the detection module includes a module

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for detecting an incoming message.

673. The apparatus of claim 672, wherein the output module includes a module for outputting the message for presentation on the display device.

674. The apparatus of claim 665, wherein the detection module includes a module for detecting an incoming web page.

675. The apparatus of claim 674, wherein the output module includes a module for outputting the web page for presentation on the display device.

676. The apparatus of claim 665, further including:

a module for receiving a play signal to restart the video program; and

a module for transmitting, in response to the play signal, the video program for presentation on the display device starting at an approximate location where the video program was paused.

677. The apparatus of claim 676, further including:

a module for receiving a fast forward signal to increase a rate of transmission of the video program; and

a module for transmitting, in response to the fast forward signal, video program at an increased rate for presentation of an increased rate of display of the video program on the display device.

678. The apparatus of claim 676, further including:

a module for receiving a rewind signal to reverse a rate of transmission of the video program; and

a module for transmitting, in response to the rewind signal, the video program at a reversed rate for presentation of a reversed rate of display of the video program on the display device.

679. The apparatus of claim 676, further including:

a module for receiving a slow motion signal to decrease a rate of transmission of the video program; and

a module for transmitting, in response to the slow motion signal, the video program at an decreased rate for presentation of a decreased rate of display of the video program on the display device.

680. The apparatus of claim 665, further including:

a module for receiving a frame forward signal to display a next frame of the video program; and

a module for transmitting, in response to the frame forward signal, a next frame of the video program for presentation of the next frame on the display device.

681. The apparatus of claim 665, further including:

a module for receiving a frame back signal to display a previous frame of the video program; and

a module for transmitting, in response to the frame back signal, a previous frame of the video program for presentation of the previous frame on the display device.

682. The apparatus of claim 676, further including:

a module for receiving a jump signal to display the video program from a current point of transmission; and

a module for transmitting, in response to the jump signal, the video program for presentation of the video program from the current point of transmission on the display device.

683. The apparatus of claim 665, wherein the receive module includes a module for receiving information to associate with a particular phone number.

684. The apparatus of claim 683, wherein the module for receiving information includes a module for receiving textual information or graphical information.

685. The apparatus of claim 683, wherein:

the detection module includes a module for detecting occurrence of an incoming telephone call associated with the particular phone number; and

the output module includes a module for outputting the signal for displaying the information associated with the particular phone number.

686. A computer program product, comprising:

a computer-readable medium containing instructions for controlling a computer system to perform a method for automatically pausing a video program in response to an occurrence of an event, the method including:

receiving a video program and outputting the video program for presentation on a display device;

detecting occurrence of a communications event during the video program;

pausing the video program in response to the detection of the occurrence of the communications event; and

outputting a signal for displaying an indication of the occurrence of the

communications event.

687. The computer program product of claim 686, wherein the detecting step includes detecting an incoming telephone call.

688. The computer program product of claim 687, wherein the outputting the signal step includes outputting the signal for displaying a telephone number associated with the incoming telephone call.

689. The computer program product of claim 688, wherein the outputting the signal step includes outputting the signal for displaying a text message associated with the telephone number.

690. The computer program product of claim 688, wherein the outputting the signal step includes outputting the signal for displaying a graphic associated with the telephone number.

691. The computer program product of claim 686, wherein the detecting step includes detecting an incoming e-mail message.

692. The computer program product of claim 691, wherein the outputting the signal step includes outputting the e-mail message for presentation on the display device.

693. The computer program product of claim 686, wherein the detecting step includes detecting an incoming message.

694. The computer program product of claim 693, wherein the outputting the signal step includes outputting the message for presentation on the display device.

695. The computer program product of claim 686, wherein the detecting step includes detecting an incoming web page.

696. The computer program product of claim 695, wherein the outputting step includes outputting the web page for presentation on the display device.

697. The computer program product of claim 686, further including:

receiving a play signal to restart the video program; and

transmitting, in response to the play signal, the video program for presentation on the display device starting at an approximate location where the video program was paused.

698. The computer program product of claim 697, further including:

receiving a fast forward signal to increase a rate of transmission of the video program; and

transmitting, in response to the fast forward signal, video program at an

increased rate for presentation of an increased rate of display of the video program on the display device.

699. The computer program product of claim 697, further including:

receiving a rewind signal to reverse a rate of transmission of the video program; and

transmitting, in response to the rewind signal, the video program at a reversed rate for presentation of a reversed rate of display of the video program on the display device.

700. The computer program product of claim 697, further including:

receiving a slow motion signal to decrease a rate of transmission of the video program; and

transmitting, in response to the slow motion signal, the video program at an decreased rate for presentation of a decreased rate of display of the video program on the display device.

701. The computer program product of claim 686, further including:

receiving a frame forward signal to display a next frame of the video program; and

transmitting, in response to the frame forward signal, a next frame of the video program for presentation of the next frame on the display device.

702. The computer program product of claim 686, further including:

receiving a frame back signal to display a previous frame of the video program; and

transmitting, in response to the frame back signal, a previous frame of the video program for presentation of the previous frame on the display device.

703. The computer program product of claim 697, further including:

receiving a jump signal to display the video program from a current point of transmission; and

transmitting, in response to the jump signal, the video program for presentation of the video program from the current point of transmission on the display device.

704. The computer program product of claim 686, wherein the receiving step includes receiving information to associate with a particular phone number.

705. The computer program product of claim 704, wherein the receiving

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information step includes receiving textual information or graphical information.

706. The computer program product of claim 704, wherein:

the detecting step includes detecting occurrence of an incoming telephone call associated with the particular phone number; and

5   the outputting step includes outputting the signal for displaying the information associated with the particular phone number.

707. A method for automatically pausing a video program in response to an occurrence of an event, comprising:

receiving a video program and outputting the video program for presentation

10   on a display device;

detecting occurrence of a communications event during the video program;

displaying an indication of the communications event;

detecting a triggering event related to the communications event; and

pausing the video program in response to the detection of the triggering event.

15   708. The method of claim 707, wherein the displaying step includes displaying an icon.

709. The method of claim 707, wherein the displaying step includes displaying an overlay menu or a hidden menu.

710. The method of claim 707, wherein the displaying step includes displaying an

20   indication of a phone call, e-mail message, message, or web page.

711. The method 707, wherein the detecting the triggering event step includes detecting a phone off-hook condition, selection of an e-mail indication, selection of a message indication, or selection of a web page indication.

3815.15

Figure 1

Figure 2

207

200

Compression Bed

Hughes

GE

Analog birds

Digital Compression System

Digital Compressed Home

Traditional Cable

TV

A
B
C
D
E
F
G
H
I–Z tuner

Analog Cable Home

Interactive Services

Analog Cable System

Analog Cable Home

HDTV Sources

Traditional Analog Cable Satellite Services

Entertainment Rights Holders

Specialty Channels

International Time-Life

Request

Viewers Choice

Discovery Communications, Inc.

Documentary, News, Non-Entertainment Rights Holders

Discovery
BBC
PBS
ABC news
NBC news

CBS News
Fox
National Geo
Turner
Independents

202

212

YOUR CHOICE

TV

A
B Sports
C Children
D Documentary
E Entertainment
F Specialty Channels
G
H HDTV
I Interactive Services
J Future

Sports Rights Holders

Childrens Rights Holders

Independents/International
Disney
Nickelodeon
Turner
PBS

Figure 3

Figure 4

645

220

channel	time
36	1:25

635

630   640   Figure 5a

220

Video   Audio   Upgrade
                                          Port
output input output   phone RS 422

○R ○   □   □
○L

650   652   654   Figure 5b   658   660   662   664

656

Figure 6

Figure 7a

Figure 7b

Figure 8

FIG. 9a

FIG. 9b

FIG. 10

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Set Top Terminal Upstream Data Transmission Hardware

FIG. 11

FIG. 12a

FIG. 12b

15 / 32

FIG. 13a

362

376

372

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374

376

FIG. 13b

350

FIG. 14

FIG. 15

FIG. 16a

Current Time: 9:45 pm	Broadcast TV Menu	Welcome!

Categories of
Program Menus

press GO for any category

Favorite Channels	Often Watched Channels
Popular Shows	Children's Programs
Murder/Mystery Programs	Documentaries
News and Information	Other

press Go here to return to home menu

MOOD QUESTION MENUS

LENGTH OF PROGRAM DESIRED

Short	30 minutes or less
Medium	30 to 60 minutes
Long	60 minutes or more

FIG. 16b

Type of Program Desired

Serious

Thoughtful

Light

FIG. 16c

Do you wish an active or passive program?

Active

Passive

FIG. 16d

STT CHANNEL SWITCHING HARDWARE: CHANNEL SWITCHING
WITHIN 6MHz BANDWIDTH

FIG. 17a

FIG. 19a

23 / 3 2

FIG. 18

1120

STT CHANNEL SWITCHING HARDWARE: CHANNEL SWITCHING
OUTSIDE 6MHz BANDWIDTH

FIG. 17b

25 / 3 2

FIG. 19b

28 / 3 2

FIG. 20a

1142

1140

27 / 3 2

FIG. 20b

FIG. 20c

1152

1150

FIG. 20d

1156

FIG. 21

1162

1164

1160

FIG. 22

1170

FIG. 23